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THE

SILVA OF NORTH AMERICA

A DESCRIPTION OF THE TREES WHICH GROW NATURALLY IN NORTH AMERICA EXCLUSIVE OF MEXICO

BY

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Illustrated with Figures and Analyses drawn from Nature

BY

CHARLES EDWARD FAXON

SUPPLEMENT

VOLUME XIV

CARICACEÆ—CONIFERÆ

GENERAL INDEX

BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
MDCCCCII

Mo. Bot. Garden
1903.

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The Riverside Press, Cambridge, Mass., U. S. A.
Electrotyped and Printed by H. O. Houghton and Company.

To

CHARLES EDWARD FAXON

THIS FINAL VOLUME

IS DEDICATED

IN GRATEFUL APPRECIATION OF THE SKILL AND LEARNING

WHICH FOR TWENTY YEARS HE HAS DEVOTED

WITH UNTIRING ZEAL TO

THE SILVA OF NORTH AMERICA

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SILVA OF NORTH AMERICA.

CARICA.

FLOWERS regular, monœcious or polygamo-diœcious, in axillary cymose panicles; calyx minute, 5-lobed; petals 5; stamens 10; filaments in two series, free; ovary 1-celled; ovules numerous. Fruit baccate, fleshy. Leaves alternate, long-petiolate, palmately lobed or digitate, rarely simple, destitute of stipules.

Carica, Linnæus, *Gen.* 309 (1737). — Meissner, *Gen.* pt. ii. 89. — Endlicher, *Gen.* 933. — Roemer, *Fam. Nat. Syn.* ii. 121. — Bentham & Hooker, *Gen.* i. 815. — Solms-Laubach, *Engler & Prantl Pflanzenfam.* iii. pt. vi. a, 98.

Papaya, Adanson, *Fam. Pl.* ii. 357 (1763). — A. L. de Jussieu, *Gen.* 399. — Baillon, *Hist. Pl.* iv. 320 (excl. *Jacaritia*).

Vasconcellea, Saint-Hilaire, *Mém. Acad. Sci.* xv. 324 (1838).

Vasconcellosia, Caruel, *Nuov. Gior. Bot. Ital.* viii. 22 (1876).

Mocinna, La Llave, *La Naturaleza*, vii. Appx. 70 (not Lagasca nor Bentham) (1885).

Small short-lived trees, filled with bitter milky juices, with erect simple or rarely branched stems composed of a thin shell of soft fibrous wood surrounding a large central cavity divided by thin soft cross partitions at the nodes and covered with thin green or gray bark marked by the ring-like scars of fallen leaf-stalks, and stout soft fleshy roots, or rarely herbaceous, with tuberous roots.[1] Leaves crowded toward the top of the stem and branches, alternate, large, flaccid, long-petiolate, subpeltately palmately nerved, usually deeply and often compoundly lobed, or occasionally digitate and seven or eight-foliate, or rarely ovate-lanceolate, destitute of stipules. Flowers white, yellow, or greenish white, in axillary cymose panicles, the staminate elongated pedunculate and many-flowered, the pistillate abbreviated and few usually three-flowered, generally unisexual and diœcious, occasionally polygamo-diœcious, each flower in the axil of a minute ovate acute flat bract. Staminate flower: calyx minute, five-lobed; corolla salverform, gamopetalous, the tube elongated, five-lobed, the lobes oblong or linear, valvate or contorted in æstivation; stamens ten, inserted on the throat of the corolla, in two rows; filaments free, those of the outer row alternate with the lobes of the corolla, elongated, the others alternate with them, abbreviated; anthers attached below the middle, introrse, two-celled, erect, opening longitudinally, often surmounted by their slightly elongated connective; pollen grains globose, grooved; ovary rudimentary, subulate. Pistillate flower: calyx minute, five-lobed, enlarged, thickened and persistent under the fruit; corolla polypetalous; petals five, linear-oblong, erect, ultimately spreading above the middle, deciduous; staminodia wanting. Ovary free, sessile, one-celled or more or less spuriously five-celled by the projection inward of the five parietal placentas; style wanting or abbreviated; stigmas five, linear, radiating, dilated and subpalmately lobed at the apex, or simple and stigmatic over the whole upper surface; ovules indefinite, inserted in two rows on the placenta, anatropous, long-stalked, micropyle superior, raphe ventral. Hermaphrodite flower: corolla gamopetalous, tubular-campanulate, the lobes erect and

[1] The stems of *Carica caudata* (Brandegee, *Zoë*, iv. 401 [1894]) of Lower California are described as herbaceous, from eighteen inches to three feet tall, and as produced from tuberous roots.

spreading or subreflexed; stamens ten, in two ranks, or five; ovary obovoid-oblong, longer than the tube of the corolla, more or less spuriously five-celled below. Fruit baccate, yellow, orange-colored, purple, or crimson, slightly five-lobed, one-celled or more or less completely five-celled, filled with soft pulp or containing a large central cavity, many-seeded, that produced from hermaphrodite flowers long-stalked, pendulous, usually unsymmetrical, or gibbous by the abortion of one of the placentas, and smaller than that from the pistillate flowers. Seeds drupaceous, ovoid, inclosed in membranaceous silvery white sac-like arils, occasionally germinating within the fruit;[1] testa crustaceous, closely investing the membranaceous inner coat, the outer portion becoming thick, rugose, succulent, and ultimately dry and leathery. Embryo in the axis of fleshy albumen; cotyledons ovate, foliaceous, compressed, longer than the terete radicle turned toward the minute pale subbasilar hilum.[2]

Carica inhabits southern Florida and the West Indies, the slopes of the coast mountains which border the southern shores of the Caribbean Sea, the Andes from Mexico to Chili, the valleys of the Pacific coast of tropical South America, southern Brazil, and Argentina.[3] Twenty species have been described, but it is probable that the forests which clothe the Cordilleras of South America, where this genus is represented by the largest number of species, hide others still unknown to science.[4]

The milky juice of Carica, which is most abundant in the unripe fruit, contains an enzyme, papain, which, like pepsin, has the power of digesting albuminous substances, and Carica leaves are commonly used in tropical countries to make tough meat more tender.[5] The fruit of *Carica Papaya*, the pawpaw,

[1] Masters, *Gard. Chron.* ser. 3, ii. 716, f. 138, 139; xii. 618, f. 92, 93. — Fritz Müller, *Flora*, 1890, 332, f.

[2] The species of Carica have been grouped by Solms-Laubach (*Martius Fl. Brasil.* xiii. pt. iii. 177; *Engler & Prantl Pflanzenfam.* iii. pt. vi. a, 98) in three sections.

(1.) Vasconcellea. Divisions of the corolla contorted or valvate in æstivation; stigma linear, undivided; ovary and fruits spuriously five-celled.

(2.) Hemipapaya (A. de Candolle, *Prodr.* xv. pt. i. 415 [sect. Vasconcellea]). Divisions of the corolla contorted in æstivation; stigma dilated and divided at the apex; ovary and fruits spuriously five-celled.

(3.) Eupapaya. Divisions of the corolla contorted in æstivation; stigmas irregularly divided to the base; ovary and fruits one-celled.

[3] See Hieronymus, *Pl. Diaphor. Argent.* 121. — Solms-Laubach, *Martius Fl. Brasil. l. c.* 178. — Donnell Smith, *Bot. Gazette*, xxiii. 247.

[4] Spruce (*Jour. Linn. Soc.* x. 7) in an account of the distribution of the *Papayaceæ*, in addition to the twenty-five species described in 1869, alludes to eleven others which had been seen by him in the forests of the Andes and on the Pacific coast of South America. What proportion of these belong to the genus Carica does not appear. In the *Flora Brasiliensis* Solms-Laubach describes twenty-two species in this family, eighteen of these belonging to Carica.

In addition to the species, there is a hybrid Carica described by Van Volxem and obtained by him in 1876 by impregnating the flowers of *Carica erythrocarpa* (André, *Ill. Hort.* xviii. 33, t. 51 [1871]), a small scarlet-fruited species of the warmer parts of Colombia and Peru, with the pollen of *Carica Candamarcensis*. From this cross a number of plants were raised which displayed their hybrid origin in the character of the leaves, intermediate in form and texture between those of the two parents. In the summer of 1879 two of these hybrid plants flowered; one produced one female and a number of male flowers, and the other only two female flowers. The female flower of the first plant was impregnated with the pollen of *Carica Candamarcensis*, and those of the other with pollen taken from its own male flowers. All three grew into red fruits and produced seeds from which many seedlings were raised. These seedling plants produced male and female flowers almost exclusively on different individuals, although in the case of both their parents the same plant produces male and female flowers. The fruit of this second cross was bright red, fragrant, oblong-obovate, slightly ribbed, five-sided, four inches long, and two and a half inches in diameter. It remained on the plants for more than a year, and is described as very ornamental. (See Van Volxem, *Gard. Chron.* n. ser. xiv. 729; xix. 445, f. 68. — Masters, *l. c.* ii. f. 139.)

[5] See Holder, *Mem. Wern. Nat. Hist. Soc.* iii. 245 (*Account of the Effects of the Juice of the Papaw Tree* [*Carica Papaya*] *in Intenerating Butcher's Meat*). — Endlicher, *Enchirid. Bot.* 487; *Med. Pfl.* 457. — Martin, *Brit. Med. Jour.* 1885, ii. 150; *Pharm. Jour. and Trans.* ser. 3, xvi. 129; *Am. Jour. Pharm.* lvii. 569; lviii. 439. — Rusby, *Druggist's Bull.* iii. 220, f. — *U. S. Dispens.* ed. 16, 1883.

Experiments made by Morong (*Bull. Pharm.* v. 166) to determine the digestive potency of the leaves of *Carica Papaya* and of *Carica quercifolia* showed the following results: —

Small cubes of cooked fresh lean beef were inclosed in several folds of the leaves of *Carica Papaya*, numerous incisions being made with a razor across the epidermis of some of the leaves in order to secure an outlet for the milky secretions, while others were left in a natural state. At the end of two days it was found that the largest cubes inclosed in the uncut leaves were considerably corroded and their edges rounded, while the minute pieces of meat had been reduced to a pulpy mass and, in some instances, dissolved into a greasy slime which had become widely spread over the surface of the leaves. At the end of five days the digestive process had reduced the largest pieces of meat to pulp, and at the end of a week all that could be seen of the meat was a thin greasy liquid covering the portions of the leaf in contact with it. The cut leaves soon lost their potency and made but little impression on the meat, probably, as Dr. Morong suggests, because owing to the admission of air the leaves soon became dry and lost their power of inteneration. Pieces of meat placed within the folds of the split petioles, from which milky juice exuded freely, were not influenced by it at all, the meat simply drying up. It is probably essential, therefore, for digestive action that the meat should be closely wrapped in the leaves to exclude the air from it, and so insure perfect contact with their

is considered one of the most wholesome of all tropical fruits, and *Carica Candamarcensis*[1] is cultivated on the Andes of Ecuador as a fruit-tree. In Argentina the juice of *Carica quercifolia*,[2] like that of *Carica Papaya*, is considered a valuable anthelmentic, and is thought useful in the treatment of pulmonary affections; the flowers are esteemed as pectorals and the leaves are employed in washing as a substitute for soap.[3]

In Florida Carica is not known to be injured by insects or attacked by fungal diseases.[4]

The generic name is from the Carib name of *Carica Papaya* in use in Hispaniola when the Spaniards first invaded that island.[5]

gastric secretions. The leaves of *Carica quercifolia* were found to be even more potent than those of *Carica Papaya* in their effects upon meat, the dissolution proceeding more rapidly, as much being accomplished in one day as in two days by the leaves of *Carica Papaya*. Experiments made with the whites and yolks of hard-boiled eggs showed that the leaves of the two species acted with equal potency and far more rapidly than they had on the pieces of meat. In twenty-four hours the outside layers of the albuminous particles had slimed off, and at the end of three days small pieces had become entirely dissolved, remaining on the surface of the leaf in the form of a thin liquid. At the end of three or four days only a slight decomposition was noticed on the surface of the yolk of the egg, and the leaves withered before any decisive effect was produced.

Papain and papayotin were at one time recommended in the United States as substitutes for pepsin in the treatment of diphtheria, to assist digestion, and as a galactagogue. (See Parke, Davis & Co., *Organic Mat. Med.* ed. 2, 43.) Recent experiments show, however, that in starch-digesting properties papain is really inferior to pepsin, and although good results have followed its use in the treatment of dyspeptic conditions, the same results are now obtained with greater certainty by the use of other agents, while in the cure of diphtheria it has been replaced by antitoxin treatment and the local application of germicides.

[1] Hooker f. *Bot. Mag.* ci. t. 6198 (1875). — Solms-Laubach, *Martius Fl. Brasil.* xiii. pt. iii. 184.

Carica Candamarcensis is a common species of the equatorial Andes, where it is cultivated as a fruit-tree up to elevations of nine thousand feet above the sea-level. The fruits are described as bright yellow, eight or nine inches long and sometimes nearly as broad, with white soft flesh usually of pleasant flavor, although sometimes acid when the plant has grown in cool situations. (See Valasco, *Historia Natural de Quito*, 58. — Spruce, *Jour. Linn. Soc.* x. 11.)

[2] Hieronymus, *Pl. Diaph. Fl. Argent.* 122 (1882). — Solms-Laubach, *l. c.* 178.

Vasconcellea quercifolia, Saint-Hilaire, *Mém. Acad. Sci.* xv. 324 (1838). — A. de Candolle, *Prodr.* xv. pt. i. 416.

Carica hastata, Brignoli, *Mem. Soc. Ital. Sci. Modena*, ser. 2, i. 77 (1862).

Vasconcellosia hastata, Caruel, *Nuov. Giorn. Bot. Ital.* viii. 22, t. 2 (1876).

[3] See Morong, *Bull. Pharm.* v. 163, t.

[4] There is no record of any fungi infesting *Carica Papaya* in the United States, although a number of species attack it in other parts of the world, and probably some of these will be found in this country.

[5] Oviedo, *Hist. Gen. Nat. Ind.* lib. viii. cap. 33.

CARICA PAPAYA.

Pawpaw.

STIGMA divided to the base into 5 radiating lobes, dilated and 3-parted at the apex. Fruit 1-celled. Leaves ovate or orbicular, deeply 5 to 7-lobed.

Carica Papaya, Linnæus, *Spec.* 1036 (1753). — Miller, *Dict.* ed. 8, No. 1. — Aublet, *Pl. Guian.* ii. 909. — Aiton, *Hort. Kew.* iii. 409. — Willdenow, *Spec.* iv. pt. ii. 814. — Persoon, *Syn.* ii. 626. — Lunan, *Hort. Jam.* ii. 36. — Stokes, *Bot. Mat. Med.* iv. 565. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 124. — Nuttall, *Gen.* ii. 243. — Lindley, *Bot. Reg.* vi. t. 459. — Kunth, *Syn. Pl. Æquin.* i. 430. — Vellozo, *Fl. Flum.* ed. 2, 427; *Icon.* x. t. 130. — Sprengel, *Syst.* iii. 905 — Hooker, *Bot. Mag.* lvi. t. 2898, 2899. — Don, *Gen. Syst.* iii. 44. — Schnizlein, *Icon.* iii. t. 200, f. 1–3, 14–18. — Spach, *Hist. Vég.* xiii. 316. — Roemer, *Fam. Nat. Syn.* ii. 122. — Bentham, *Bot. Voy. Sulphur*, 100. — Seemann, *Bot. Voy. Herald*, 128. — Grisebach, *Fl. Brit. W. Ind.* 290. — Sauvalle, *Fl. Cub.* 54. — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 56 (*Fl. St. Croix and the Virgin Islands*). — Lefroy, *Bull. U. S. Nat. Mus.* No. 25, 76 (*Bot. Bermuda*). — Hieronymus, *Pl. Diaph. Fl. Argent.* 121. — Hemsley, *Bot. Biol. Am. Cent.* i. 481. — Chapman, *Fl.* ed. 2, Suppl. 621. — *Wien. Ill. Gart. Zeit.* ix. 448, f. 66. — Solms-Laubach, *Martius Fl. Brasil.* fasc. cvi. 188, t. 49. — Duss, *Ann. Inst. Col. Marseille*, iii. 310 (*Fl. Antill. Françaises*).

Papaya cucumerina, Norona, *Verhand. Bat. Genoot. Konst. Wet.* v. 23 (1790).

Papaya communis, Norona, *Verhand. Bat. Genoot. Konst. Wet.* v. 23 (1790).

Papaya Carica, Gærtner, *Fruct.* ii. 191, t. 122, f. 2 (1791). — Baillon, *Hist. Pl.* iv. 283, f. 332–336. — Otto Kuntze, *Rev. Gen. Pl.* i. 253.

Papaya vulgaris, De Candolle, *Lamarck Dict.* v. 2 (1804). — Poiret, *Lamarck Ill.* iii. 410, t. 821. — Nuttall, *Sylva*, iii. 47, f. 96. — Cooper, *Smithsonian Rep.* 1858, 264. — A. de Candolle, *Prodr.* xv. pt. i. 414.

Papaya sativa, Tussac, *Fl. Med. Antill.* iii. 45, t. 10, 11 (1824).

Caryca mamaya, Vellozo, *Icon.* x. t. 131 (1827); *Fl. Flum.* ed. 2, 427.

Carica hermafrodita, Blanco, *Fl. Filip.* 805 (1837); ed. 3, iii. 212.

Papaya edulis, α macrocarpa, Bojer, *Hort. Maurit.* 277 (1837).

Papaya edulis, β pyriformis, Bojer, *Hort. Maurit.* 277 (1837).

The Pawpaw, which lives only for a few years, although the original trunk is sometimes replaced by others from the same root, in Florida rarely attains a greater height than twelve or fifteen feet, and its simple stem is seldom more than six inches in thickness; in the West Indies and other tropical countries it often grows to twice this size, and the stem occasionally divides into a number of stout upright branches.[1] The bark is thin, light green except toward the base of the stem, where it finally becomes gray, and closely invests the thin layer of woody fibres which give to the stem its only strength and within which a layer of soft tissues often half an inch in thickness forms the wall of the broad central cavity divided at the nodes by thin porous cross partitions. The stem is supported by a stout tap-root which penetrates the soil to the depth of twelve or eighteen inches, and by numerous thick fleshy lateral roots spreading under the surface for a distance of two or three feet. The leaves are ovate or orbicular in outline, deeply divided into from five to seven lobes which are themselves more or less deeply divided into acute lateral lobes, these secondary divisions being entire or rarely lobed; the lowest of the principal lobes are smaller than the others, nearly parallel and form deep sinuses at the base of the leaf; the leaves are thin and flaccid, yellow-green, and from fifteen to twenty-four inches in diameter, with broad flat yellow or orange-colored primary veins radiating from the end of the petiole through the lobes, and small secondary veins extending to the points of the lateral lobes and connected by conspicuously reticulate veinlets; they are borne on stout yellow hollow petioles,

[1] See *Gard. Chron.* n. ser. xxiii. 141. It is probable that *Carica Papaya* does not develop branches unless the terminal growing point of the stem is injured.

enlarged and cordate at the base, which, continuing to grow, sometimes become three or four feet in length before the leaves fall. The flowers, which often begin to appear on plants only three or four feet high and a few months old, are pale yellow, with minute or foliaceous calyx-lobes,[1] and are produced continuously throughout the year, the males in many-flowered racemose cymes borne on slender spreading or pendulous peduncles which vary from four to twelve inches in length, and the females in one to three-flowered short-stalked cymes.[2] The staminate flowers are fragrant and contain large quantities of nectar; and their corolla is from three quarters of an inch to an inch and a quarter long, with a slender tube and acute lobes which in the same cluster are in some flowers dextrorse and in others sintrorse in æstivation. The anthers are oblong, orange-colored, and surmounted by the rounded thickened end of their connective, those of the inner row being almost sessile and one third larger than those of the outer row; these are rather shorter than their flattened filaments which are covered, like the connectives of the anthers, with long slender white hairs. The rudimentary ovary is subulate and much shorter than the tube of the corolla. The pistillate flower is about an inch long, with linear lanceolate erect petals free to the base, dextrorsally contorted in æstivation, and reflexed above the middle at maturity; it is destitute of staminodia, and the ovary is ovoid, ivory white, slightly and obtusely five-angled, one-celled, and narrowed into a short slender style crowned by a pale green stigma divided to the base into five radiating lobes, which are dilated and deeply three-cleft at the apex; the ovules are raised on long stalks. The fruits, which hang close together against the stem at the base of the leaf-stalks, are obovate, ellipsoidal, and obtusely short-pointed, and vary in color from yellowish green to bright orange-color; on trees cultivated in the tropics they are sometimes from ten to twelve inches long, while on the trees which grow spontaneously in southern Florida they are occasionally four inches in length and three inches in thickness, although usually smaller. Their thick skin closely adheres to the firm sweet rather insipid flesh which varies greatly in amount and quality on different plants and forms a thin layer outside the central cavity, which is filled with a mass composed of the nearly black seeds. These are full and rounded and about three sixteenths of an inch in length; when the fruit is full grown but still green the outer rugose portion of the testa is ivory white, very succulent, and easily separable from the smooth paler chestnut-brown lustrous interior portion, but as the fruit ripens the outer part of the testa turns black, and, becoming dry and leathery, adheres closely to the inner portion which closely invests the thin lustrous light red-brown inner seed-coat. The fruit decays on the tree, and, then drying up, finally splits open, letting the seeds fall to the ground.

Carica Papaya now inhabits southern Florida from the southern shores of Bay Biscayne on the west coast and Indian River on the east coast to the southern keys, growing sparingly in rich hummocks under the shade of Live Oaks, Mulberries, Bay-trees, and Magnolias; it is very common in all the West Indian Islands, in Mexico, and in the tropical countries of South America; and it has now become naturalized in most of the warm regions of the Old World.[3]

[1] The calyx-lobes of Carica are described as minute, but on specimens taken from two trees growing in hummocks near Miami on the shores of Bay Biscayne, Florida, from which the plate in this work has been made, two of the calyx-lobes of both staminate and pistillate flowers were much enlarged and foliaceous.

[2] In Florida, so far as I have been able to learn, the staminate and pistillate flowers of wild plants of *Carica Papaya* are produced on different individuals, but on cultivated plants in Florida and in other countries they are often andro-dicœcious; that is, the male plants occasionally bear at the apex of the principal branches of the inflorescence hermaphrodite flowers which differ from the pistillate flowers chiefly in their tubular-campanulate corolla and in the ten or rarely five stamens inserted in two rows on its throat. The fruit, which is developed from these hermaphrodite flowers and which hangs on long peduncles, is usually smaller than that produced on the pistillate trees, and is nearly always unsymmetrical. (See Correa de Mello & Spruce, *Jour. Linn. Soc.* x. 1 [*Notes on Papayaceæ*]. — H. O. Forbes, *Jour. Bot.* xvii. 313. — Matthews & Scott, *Trans. Bot. Soc. Edinburgh*, xi. 287.) Andro-dicœcious flowers of *Carica Papaya*, the pistillate trees bearing also a few hermaphrodite flowers, have been noticed by Ernst in Caracas (*Jour. Bot.* iv. 81) on *Carica Papaya;* and by Baillon on a plant cultivated in Paris (*Bull. Soc. Linn. Paris*, No. 84, 665).

[3] Cultivated for its edible fruit no doubt long before the discovery of America by Europeans, and easily scattered by the facility with which its seeds germinate in waste places, the original home in tropical America of *Carica Papaya* cannot be determined with any certainty. Correa de Mello & Spruce (*l. c.* 8), who had excellent opportunities for studying the flora of large regions of continental South America, believed, however, that the West

In all tropical countries the Pawpaw is universally cultivated for its fruit[1] and in waste places near human habitations it springs up in great abundance.

In appearance one of the most remarkable of the plants of the New World, the Pawpaw at once attracts the attention of travelers in the tropics, and after Oviedo y Valdes wrote the first account[2] of it during the first half of the sixteenth century many early explorers and many botanists before the time of Linnæus described it.

Indies was the true home of the Pawpaw, that it had spread southward across the continent by cultivation, and that it was nowhere truly wild on the mainland, although they had seen near Tarapota in the eastern Peruvian Andes, at the height of two thousand feet above the sea, the staminate plants growing in a continuous thicket of several acres in extent. In the forests of this region, nevertheless, no truly wild plants could be found.

The Pawpaw was carried to Asia before the end of the sixteenth or very early in the seventeenth century no doubt by the Portuguese, for in 1626 Petro de Valle brought the seeds from the East Indies to Naples, where they produced plants. In 1651 these were described and figured by Columna in the *Rerum Medicarum Novæ Hispaniæ Thesaurus* of Francisco Hernandez, 870, as *Papaya Orientalis, sive Pepo arborescens*. Twelve years later Dr. Paludanus wrote, in the third edition of Linschoten's *Histoire de la Navigation* (chap. liv. 98), published in 1638: "Il y a aussi un fruict apporté des Indes Occidentales par les Isles Philippines à Mallacca e de là es Indes, appellé *Papaios*, ayant presques la forme d'un Melon, et est de la grosseur d'un poing." Boyn, who first visited southern China in 1643, found the Pawpaw in great abundance on the island of Hainan and in the province of Canton, and in his *Flora Sinensis* he described it among other Chinese plants as *Fan yay cv ou le Papaya*. (See Thévenot, *Relations de Divers Voyages Curieux*, i. [*Flora Sinensis*, 19].) Rheede in 1678 (*Hort. Ind. Malab.* i. 21, 23, t. 15) and Rumpf in 1741 (*Herb. Amboin.* i. 145, t. 50, 51 [see, also, Burmann, *Thes. Zeylan.* 184]) showed that the Pawpaw was of American origin. In spite of this testimony many authors continued to regard the Pawpaw as an East Indian plant until Robert Brown, arguing in 1818 that it had no Sanscrit name, that as Rumph had pointed out the inhabitants of the Indian Archipelago regarded it as an exotic plant, and that all the other species of the genus belonged to the New World, showed conclusively that it was American and not Asiatic or African. (See Tuckey, *Narrative of an Expedition to explore the River Zaire, usually called the Congo*, Appx. v. 471. See, also, A. de Candolle, *Géographie Botanique*, ii. 917; *Origine des Plantes Cultivées*, 233. — Wittmack, *Bot. Zeit.* xxxvi. 532. — Solms-Laubach, *Bot. Zeit.* xlvii. 709.)

It is doubtful if *Carica Papaya* is a native of Florida and has not been introduced there on account of the value of its fruit; yet if not indigenous it has become naturalized there as it has in so many other warm countries. The Pawpaw was first noticed in Florida in 1774 by William Bartram, who found it growing apparently in abundance on the east coast south of Mosquito Inlet, either near Hillsborough River or at the head of Indian River (*Travels*, 131). In this region, which was then uninhabited by whites, the Orange was naturalized at this time, and the Pawpaw might have been brought there by the Spaniards when they brought the Orange. It is now very common in the wooded hummocks in the neighborhood of Bay Biscayne, often remote from human habitation. Bay Biscayne, however, for more than a century has been frequented by boatmen from the Bahama Islands, who if they had carried pawpaws with them to eat might have left the seeds on the shore. The probability of recent introduction into eastern Florida is, moreover, heightened by the fact that Bernard Romans in *The Natural History of East and West Florida*, published in 1775, makes no mention of the Pawpaw, although he visited those parts of Florida, both on the east and west coasts where it is now naturalized, and paid particular attention to the trees of the peninsula. On the other hand, Dr. Robert Ridgway, who found the Pawpaw in 1897 growing on Chandler's Hummock in the Everglades near the northeast edge of Lake Okechobee, a region difficult of access and rarely visited, writes to me that "there is not the slightest question that this tropical species is indigenous to this part of south Florida. I may add that I was unable to find it except at Fort Myers, where it was cultivated, in any part of Lee County, not even in the vicinity of Fort Thompson, nor in the Big Cypress District. I believe, therefore, it is confined to the immediate vicinity of the Everglades, which are extended in a narrow strip known locally as the 'Saw Grass' region, along the western side of Lake Okechobee, quite to the mouth of the Kissimmee River." It is due to these observations made by Dr. Ridgway that *Carica Papaya* is admitted into *The Silva of North America*.

[1] Forskål, *Fl. Ægypt. Arab.* p. cxxii. — Loureiro, *Fl. Cochin.* ii. 628. — Blume, *Bijdr. Fl. Ned. Ind.* ii. 941. — Roxburgh, *Fl. Ind.* ed. 2, iii. 824. — Wight, *Ill. Ind. Bot.* ii. 34, t. 106, 107. — Wight & Arnott, *Prodr. Fl. Nepal.* 352. — Blanco, *Fl. Filip.* 803; ed. 3, iii. 212. — Hasskarl, *Cat. Pl. Bogor.* 188; *Pl. Jav. Rar.* 180. — Bojer, *Hort. Maurit.* 277. — Miquel, *Fl. Ned. Ind.* i. 697. — Van Nooten, *Fleurs Jav.* t. — Hillebrand, *Fl. Haw. Is.* 139. — Bretschneider, *Jour. North China Branch Roy. Asiatic Soc.* n. ser. xxv. 300 (*Botanicon Sinicum*, pt. ii.).

The fruit of the Pawpaw has been much improved by cultivation and selection in the West Indies. Individual fruits with thick succulent flesh and weighing ten or twelve pounds are sometimes produced on cultivated trees, while on the plants which grow spontaneously in Florida they are often not larger than a hen's egg, with thin dry scarcely edible flesh. The fruit is eaten either raw or boiled with sugar, and acts as a mild cathartic. The seeds have an aromatic pepper-like taste and are considered anthelmentic; and the juice of the unripe fruit has been employed in the treatment of psoriasis and other cutaneous affections. (See Descourtilz, *Fl. Med. Antill.* i. 215, t. 47, 48. — Ernst, *Jour. Bot.* iii. 319 [*Venezuelan Medicinal Plants*]. — Guibourt, *Hist. Drog.* ed. 7, iii. 266, f. 659. — Baillon, *Traité Bot. Med.* 833, f. 2507–2511. — Fawcett, *Economic Plants, Jamaica*, 23.)

[2] "Del árbol que en esta Isla Española llaman *papaya*, y en la Tierra-Firme los llaman los españoles los *higos del mastuerco*, y en la provinçia de Nicaragua llaman á tal árbol *olocoton*." (Oviedo, *Hist. Gen. Nat. Ind.* lib. viii. cap. 33.)

Mamœra Lusitanorum, Clusius, *Curæ Posteriores*, 41, f.

Arbor Platani folio fructu peponis magnitudine eduli, C. Bauhin, *Pinax*, 431.

"This fruit is (which a man would not thinke) a remedie against the flux, and so are their Papaies, a fruit like an Apple of a waterish welsh taste." (Layfield in *Purchas his Pilgrimes*, iv. 1172 [*A large Relation of the Porto Rico Voiage*].)

"There are store of good Roots and Plants with Fruites, as the Pina and Plantine, Potatoes, Nappoyes, and a fruite called of the *Indians Poppoyes*, it is bigger than an Apple and very pleasant to eat." (Wilson in *Purchas his Pilgrimes*, iv. 1264.)

Papanes, Smith, *Gen. Hist.* 184.

Mamœra mas & femina, Gerarde, *Herball*, ed. 2, 1608, f.; Parkinson, *Theatr.* 1649, f.

"Pappaw is a fruite as bigge as an Apple, of an Orange colour, and good to eate." (Parkinson, *Theatr.* 1671.)

Mamaœira mas & fœmina, Piso, *Nat. Hist. Bras.* lib. iii. cap. vi. 102.

De Paya, Francisco Hernandez, *Rerum Med. Nov. Hisp. Thesaurus*, 99; *Hist. Pl. Nov. Hisp.* ed. Madrid, 1790, iii. 90.

Papaie Peruvianis, Bauhin, *Hist. Pl.* i. 147.

De deux sortes de Papayers, Du Tertre, *Hist. Gen. Antill.* ii. 187.

The Papa. "The Tree, though it may be accounted wood, yet the softest that yet I ever saw; for with my knife, I can cut down a tree as big as a man's leg at one chop. The fruit we boyl, and serve it up with powdred pork, as we do turnips in *England;* but the turnip is far the more savory fruit." (Richard Ligon, *A True and exact History of the Island of Barbados*, 71.)

Pinoguacu mas & fœmina, Piso, *Nat. Hist. Bras.* ed. 2, lib. iv. cap. xxiii. 159, f.

Mamœira, Johnson, *Dendrologia*, 59, t. 25; ed. 2, i. 60, t. 25.

De Arbore melonifera Mamœra & Papaia dicta, Ray, *Hist. Pl.* ii. 1370.

Pepo arborescens fœmina sive fertilis, Hermann, *Parad. Bot. Prodr.* 362 (excl. syn.).

Papaya major, flore & fructu majoribus pediculis curtis infidentibus, Sloane, *Cat. Pl. Jam.* 202; *Nat. Hist. Jam.* ii. 164.

Ficus arbor Utriusque Indiæ *Platani foliis μονοστελέχης, fructu Mali Cydonii, aut Melonis magnitudine*, Plukenet, *Alm. Bot.* 145; *Mantissa*, t. 278, f. 1.

Papaja, Merian, *Hist. Gén. Insects de Surinam*, i. 40, t. 40; 62, t. 62; 64, t. 64.

Du Papayer, Rochefort, *Histoire Naturelle et Morale des Isles Antilles*, ed. 2, 65, f.

Pœpol, Arbor Melonifera, Hermann, *Mus. Zeylan.* 58.

Papolghaha, Papaya, Hermann, *Mus. Zeylan.* 66.

Papaya fructu Melopeponis effigie, Tournefort, *Inst.* i. 659, t. 441. — Boerhaave, *Ind. Alt. Hort. Lugd. Bat.* ii. 170.

Carica foliorum lobis sinuatis, Linnæus, *Hort. Cliff.* 461; *Fl. Zeylan.* 173. — Royen, *Fl. Leyd. Prodr.* 225.

Papaya mas, Trew, *Plantæ et Papiliones Rariores*, t. 3, f. 1.

The Popaw Tree, Griffith Hughes, *Nat. Hist. Barbados*, 181, t. 14, 15.

Papaya, fructu oblongo Melonis effigie, Trew, *Pl. Ehret.* 2, t. 7.

Carica. Fronde comosa, foliis peltato-lobatis, lobis varie sinuatis, Browne, *Nat. Hist. Jam.* 360.

EXPLANATION OF THE PLATE.

Plate DCCV. Carica Papaya.

1. A staminate inflorescence, natural size.
2. Diagram of a staminate flower.
3. A staminate flower, the corolla laid open, enlarged.
4. A pair of stamens, front view, enlarged.
5. A stamen, side view, enlarged.
6. Pistillate flowers, natural size.
7. Diagram of a pistillate flower.
8. A pistillate flower, the corolla laid open, enlarged.
9. Vertical section of an ovary, enlarged.
10. Cross section of an ovary, enlarged.
11. A stigma seen from above, enlarged.
12. An ovule, enlarged.
13. A fruit, natural size.
14. Cross section of a fruit, natural size.
15. Vertical section of a fruit, natural size.
16. A seed, enlarged.
17. A seed with its aril laid open, enlarged.
18. Vertical section of a seed, enlarged.
19. A seed with the outer layer of the seed coat removed.
20. An embryo, enlarged.
21. A leaf, reduced.
22. A seedling, natural size.

C.E. Faxon del. Rapine sc.

CARICA PAPAYA, L.

A. Riocreux direx.t Imp. J. Taneur, Paris.

OPUNTIA.

FLOWERS perfect; calyx-lobes numerous, imbricated in many series; corolla rotate; petals numerous, spreading; stamens indefinite, inserted on the base of the petals; ovary one-celled, many-ovuled. Fruit baccate. Branches tuberculate, articulate, compressed, subcylindrical, or clavate. Leaves scale-like, caducous.

Opuntia, Adanson, *Fam. Pl.* ii. 243 (1763). — Zuccarini, *Abhand. Akad. Münch.* ii. 687. — Meissner, *Gen.* 128. — Endlicher, *Gen.* 945. — Engelmann, *Proc. Am. Acad.* iii. 289. — Bentham & Hooker, *Gen.* i. 851. — Baillon, *Hist. Pl.* ix. 40 (excl. sect. *Nopalea*). — Schumann, *Engler & Prantl Pflanzenfam.* iii. pt. vi. 199.

Consolea, Lemaire, *Rev. Hort.* 1862, 174.

Tephrocactus, Lemaire, *Les Cactées*, 88 (1868).

Ficindica, St. Lager, *Ann. Soc. Bot. Lyon*, vii. 70 (1880).

Trees or usually shrubs, often low and prostrate, with flattened or subcylindrical or clavate articulate tuberculate branches covered by a thick epidermis with small sunken stomata filled with copious watery juices,[1] and with or without solid or tubular and reticulate woody skeletons, and thick and fleshy or fibrous roots. Leaves alternate, terete, subulate, small, early deciduous, bearing in their axils oblong or circular cushion-like areolæ[2] of chaffy or woolly scales terminal on the tubercles of the branches and furnished above the middle with many short slender slightly attached sharp barbed bristles, and toward the base with numerous stout barbed spines[3] surrounded in some species, except

[1] The large thin-walled parenchyma cells which form a large part of the tissue of Opuntia take up water freely when the ground is moist, and the young branches become saturated with juices and are thick, plump, and smooth. During periods of drought, which frequently last for months in the regions where these plants grow in the greatest numbers, they gradually lose their moisture by evaporation and become withered and wrinkled. With the minute caducous leaves, thick epidermis, and small sunken stomata of Opuntia, this process is a very slow one, and branches severed from the parent plant and kept in a dry atmosphere have retained sufficient moisture to produce roots and branches at the end of nearly a year. This power to retain moisture aids in the dissemination of the plant, for detached joints of the branches falling to the ground, as they often do either naturally or by being brushed against by cattle and other animals, retain, in periods even of the longest droughts, sufficient moisture to develop roots; these anchor the joints to the ground and new plants begin to grow. (See Toumey, *Bot. Gazette*, xx. 356 [*Vegetal Dissemination in the Genus Opuntia*].)

[2] "In Opuntia the pulvillus (which in its lower part is the spiniferous, and in its upper part the floriferous areola combined) is the same in all stages of development; only it is smaller on the lower part of each joint, and bears fewer or often no spines, and rarely any flowers or new shoots; while the uppermost pulvilli have the longest and most numerous spines, and bear the flowers as well as the young branches." (Engelmann, *Bot. Mex. Bound. Surv.* ii. 46.)

"The areolæ continue to grow year after year, at least for a period of several years, and each year increase in size from the inner margin, several new spines developing above the old ones. The number of spines on an areola of a first year's joint is fairly constant in the same species, but a joint several years of age may in some species bear six or seven times as many spines as the former. In *Opuntia fulgida* the spines on an areola increase in numbers with succeeding years more rapidly than in *Opuntia spinosior*. In the latter, however, they increase much more rapidly than in *Opuntia versicolor*. On this species frequently no additional spines are produced after the first year, and they are never produced in such numbers as on the two other species. In these three species, after several years' growth the vegetative activity of the areolæ ceases, and they fall away with the outer scales of the bark." (Toumey, *in litt.*)

[3] The spines of Opuntia, which are produced on most of the species and are usually stout and rigid, are barbed backward, and make these plants the most difficult and dangerous of all the Cactus family to handle, or even to approach, and render several of the large-growing specimens valuable for the protection of fields and gardens against browsing animals. The short sharp bristles mixed with soft scales, which cover the areolæ above the middle, are also barbed backward, and being very feebly attached come off with the slightest touch, penetrating the skin or adhering to the clothes of persons brushing by the plants. (See Engelmann, *l. c.* 45.)

The spines and, in a less degree, the bristles of Opuntia and of many other members of the Cactus family, which often contain the only moisture to be found in the deserts of America, have evidently been developed to protect these plants against animals suffering from thirst, who would soon exterminate them without this protection. They also play an important part in the dissemination of Opuntias, the barbed spines attaching themselves to passing animals, who carry off the easily detached joints of the branches, which sooner or later reach the ground and often form new plants. Certain species with strongly developed and numerous spines and feebly attached joints rarely produce seeds and appear to depend almost entirely on this method of propagation. (*Teste* Toumey, *in litt.* See Ganong, *Bot. Gazette*, xx. 133.)

at the apex, by a loose papery sheath, on a few species broad, flat, fleshy, and spreading,[1] rarely thin, flat, paper-like, and elongated.[2] Flowers lateral, produced from areolæ on branches of the previous year between the bristles and spines, sessile, diurnal, or rarely nocturnal, cup-shaped, often large and showy. Calyx-lobes numerous, flat, erect, deciduous. Corolla rotate; petals numerous, obovate, united at the base, spreading, red, yellow, or purple. Stamens numerous, shorter than the petals, inserted in many series on their base; filaments filiform, free or slightly united below; anthers oblong, two-celled, opening longitudinally. Ovary inferior, one-celled; style cylindrical, longer than the stamens, obclavate below, fistular above, divided at the apex into from three to eight elongated or lobulate lobes stigmatic on the inner face; ovules indefinite, horizontal, anatropous, inserted on numerous parietal placentas. Fruit baccate, sometimes proliferous, covered by a thick skin, succulent and often edible, or dry, pyriform, globose or elliptical, concave at the apex, surmounted by the marcescent tube of the flower, tuberculate, areolate or rarely glabrous, truncate at the base with a broad umbilicus.[3] Seeds numerous, immersed in the pulpy placentas, compressed, discoid, often margined with the bony raphe; testa bony, white, sometimes marked by a narrow darker colored marginal commissure. Embryo coiled around the copious or scanty albumen; cotyledons large, foliaceous; radicle thin, obtuse, turned toward the hilum.[4]

Opuntia, which originally was confined to America, has now become naturalized in many of the warm dry regions of the world.[5] About one hundred and thirty species are now recognized.[6] They are

[1] Subgenus Peireskiopuntia, Schumann, *Monog. Cact.* 651 (1898).

[2] The broad-spined species (Platyacanthæ) appear to be confined to Argentina, and are still very imperfectly known. (See W. Watson, *Gard. Chron.* ser. 3, xxiii. 339, f. 129.)

[3] Professor Toumey suggests (*in litt.*) that the so-called fruit of Opuntia is really a terminal branch of the joint containing the ripened ovary which is sunken into its apex, and that the morphology of the fruit of the whole Cactus family is probably similar. In some cases the ovary-bearing branch is highly modified. In certain species, however, particularly in the cylindrical stemmed Opuntias, it resembles a sterile terminal joint in all respects, except in the concave flower-scar at the apex. The proliferous character of the fruit, a character common in a greater or less degree to nearly all species of Opuntia, and occasionally found in other genera, would seem to indicate that this view is correct. *Opuntia spinosior* and *Opuntia versicolor* frequently produce proliferous fruits, and those of *Opuntia fulgida* are almost constantly proliferous. In the case of these species plants can be propagated by using the green fruits and even the ripe fruits as cuttings. Occasionally flat-stemmed Opuntias are found with an ovary developed in the apex of a branch resembling in all respects one of the narrow flat sterile stems of the plant. In *Opuntia versicolor* the ovary is frequently in the apex of a long joint, and there are innumerable transitions between these long fruit-joints and the typical pear-shaped fruit of the species. Ovaries in such stems are generally sterile, but occasionally contain one or many seeds.

[4] By Engelmann the species have been arranged in the following subgenera: —

Platopuntia (*Proc. Am. Acad.* iii. 289 [1856]), now usually extended to include his Stenopuntia (*l. c.*).

Joints of the branches compressed, without a woody skeleton; spines without sheaths. Fruit pulpy or rarely dry; raphe forming a prominent and bony margin round the seed. Embryo curled round the scanty albumen; cotyledons contrary to the sides of the seed.

Cylindropuntia (Engelmann, *l. c.* [1856]).

Joints of the branches cylindrical or clavate, more or less tuberculate, with or without a solid or tubular and reticulated ligneous skeleton. Spines inclosed in a loose sheath or in some species naked. Fruit fleshy or dry, setulose or spinescent. Seeds hard-shelled, smooth, often marked by a conspicuous marginal commissure, usually marginless, embryo forming less than a circle round the copious albumen; cotyledons contrary, oblique, or parallel to the side of the seed.

[5] Opuntias were probably among the first plants carried from America to the Old World, where they soon became naturalized in southern Spain; from Spain they were carried by the Arabs to northern Africa, and they have gradually and generally extended through all the warm dry parts of the world. (See A. de Candolle, *Origine des Plantes Cultivées*, 218.)

In some countries naturalized Opuntias have become dangerous weeds, destroying the value of the land which they occupy with impenetrable thickets of spiny branches. In New South Wales, where the Opuntia was introduced more than a century ago, different species have become such pests that in 1886 an act was passed compelling persons, under penalty of fine and imprisonment, to clear their land of these plants. (See Maiden, *Agric. Gazette New South Wales*, ix. 979.) In South Africa Opuntias have spread to such an alarming extent that their destruction has been a subject of serious government investigation. (See *Kew Bull. Miscellaneous Information*, July, 1888, 165; September, 1890, 186.) In India, where Opuntias have long been naturalized, it is supposed through early Portuguese introduction, they spread rapidly and are considered dangerous weeds (see Brandis, *Forest Fl. Brit. Ind.* 246); and in southern Texas hundreds of square miles of grazing land have been overrun and entirely ruined by different species of dwarf Opuntias. (See Bentley, *U. S. Dept. Agric. Farmers' Bull.* No. 72, 14 [*Cattle Ranges of the Southwest*].) On the other hand, the roots of Opuntias are said to have disintegrated the lava on the slopes of Mt. Ætna in Sicily, and, enriching it by the decay of their stems, to have gradually changed barren wastes into productive vineyards. (See Bois, *Bull. Soc. Nat. d'Acclimatation de France*, sér. 4, v. 643.)

[6] See De Candolle, *Prodr.* iii. 471. — Seemann, *Bot. Voy. Herald*, 293. — Engelmann, *Proc. Am. Acad.* iii. 289; *Bot. Mex. Bound. Surv.* ii. 45; *King's Rep.* v. 118; *Brewer & Watson Bot. Cal.* i. 247. —

distributed from southern New England southward in the neighborhood of the coast to the West Indies, and from southern British Columbia through western North America to Chili, the Galapagos Islands,[1] Brazil, and Argentina, the largest number of species occurring in the arid region near the boundary between the United States and Mexico. Of the species of the United States three attain on the deserts of southern Arizona the size and habit of small trees.

Cochineal[2] is derived from a scale-insect, *Coccus Cacti*, which feeds on the juices of *Opuntia*

Philippi, *Linnæa*, xxxiii. 82; *Cat. Pl. Chil.* 93. — Hemsley, *Bot. Biol. Am. Cent.* i. 549. — Schumann, *Martius Fl. Brasil.* iv. pt. ii. 302; *Monog. Cact.* 650. — Coulter, *Contrib. U. S. Nat. Herb.* iii. 418.

[1] On the Galapagos Islands, on the equator nearly seven hundred and fifty miles from the coast of Ecuador, the most isolated known station inhabited naturally by any Opuntia, occurs the largest representative of the genus. This is: —

Opuntia Galapageia, Henslow, *Mag. Zoöl. Bot.* i. 467, t. 14, f. 2 (1837). — Hooker f. *Trans. Linn. Soc.* xx. 223. — Andersson, *Stockh. Akad. Handl.* 1853, 95 (*Om Galapagos-Öarnes Veg.*). — Hemsley, *Gard. Chron.* ser. 3, xxiv. 265, f. 75. — Schumann, *Monog. Cact.* 747.

Opuntia Galapageia, which is one of the flat-branched species, although frequently shrubby grows under favorable conditions to the height of twenty feet, with a trunk two feet in diameter and stout spreading branches. (See Bauer, *Biol. Centralblatt*, xii. 247 [*Ein Besuch der Galapagos-Inseln*].)

[2] Cochineal, which consists of the females of *Coccus Cacti*, Linnæus, an hemipterous insect, is a dye used for the production of scarlet, crimson, orange, and other tints, and in the preparation of lake and carmine paints. It owes its tinctorial power to the presence of cochinealin or carmanic acid, which is composed of hydrogen, carbon, and oxygen. The male insect is half the size of the female, with long white wings and a dark red body terminating in two diverging setæ, and is devoid of a nutritive apparatus. The female has a dark brown body and no wings, and occurs in the proportion of from one hundred and fifty to two hundred to one of the males. When the Spaniards entered Mexico in 1518 they found cochineal employed by the inhabitants in coloring their dwellings and garments, the dry insects, which they reared with the greatest care on plantations of the Opuntias, forming one of the staple tributes from certain provinces, probably chiefly from Oaxaca, the little village of Cuilapan being usually considered the original home of the cochineal industry. (See Clavigero, *Storia Antica del Messico*, i. 114, nota. — Prescott, *Conquest of Mexico*, ii. 136.) For a century and a half after its introduction into Europe cochineal was believed to consist of the seeds of a Cactus or some other vegetable substance (see Caneparius, *De Atramentis*, 211), but in 1672 Martin Lister hazarded the conjecture that it might be a sort of kermes (*Phil. Trans.* vii. 5059); and in 1691 a letter containing *Observations on the making of Cochineal, according to a Relation had from an Old Spaniard at Jamaica*, published in the *Philosophical Transactions* (xvii. 502), pointed out that cochineal was really an insect. In this communication instructions for propagating the plants on which the insects feed were given, and their use in hedges described. A little later, in 1704, Leeuwenhoek with the aid of his miscroscope showed conclusively the animal nature of the dye and finally settled the question of the origin of cochineal (*Phil. Trans.* xxiv. 1614). The cochineal industry once flourished in Central America, Peru, and other parts of South America, and in 1858, after the destruction of their vineyards, its cultivation was successfully introduced into the Canary Islands, which in 1869 exported six and a half million pounds of the dye, about seventy thousand of the dried insects weighing one pound. Cochineal has also been produced in southern Spain, Algeria, India, and the Dutch East India Islands.

In Mexico the insects are sometimes gathered from wild plants, but the product is of poor quality, and the best cochineal is obtained by regular cultivation. The insects are reared in winter in huts, and from the end of May until the beginning of August are put out on plants carefully cultivated in inclosed gardens or nopalries by hanging on the branches of the Opuntias small gauze bags, each containing about a tablespoonful of the impregnated females. The young as fast as they are born escape from the bags and spread over the surface of the branch, where they absorb its juices and grow rapidly until their legs, antennæ, and probosces are almost indistinguishable. As soon as insects show signs of spawning, they are rapidly brushed into bags or baskets and are killed by immersion in hot water, by exposure to the sun, or in heated ovens, the quality of the product depending largely on the method and care used in killing and curing the insects. Two or three crops are produced in a season. The "grain," as the dried cochineal is called, is sifted to free it of an adherent white powder; it is then picked over to remove all foreign matter and packed in bags for export. There are two principal varieties recognized in commerce: silver cochineal, which is of a grayish red color, with the furrows of the body covered by a whitish bloom, and black cochineal, which is of a darker red.

The plant chiefly used to feed the cochineal insect in Mexico and Central America is *Nopalea cochenillifer*, Salm-Dyck, *Cact. Hort. Dyck.* ed. 3 (1850) (*Cactus cochenillifer*, Linnæus, *Spec.* 468 [1753], *Opuntia cochinelifera*, Miller, *Dict.* ed. 8, No. 6 [1765]), which differs from the flat-leaved Opuntias in its erect petals much shorter than the long stamens, and which is probably a native of Peru, although now widely spread by cultivation through the warmer parts of America and through other warm dry countries. The cochineal insect is also reared on *Opuntia Ficus-Indica* and on *Opuntia Tuna*, which, according to Lowe (*Hooker Jour. Bot.* i. 40; *Man. Fl. Mad.* 313), is the only species used in the Canary Islands for the purpose. In a wild state the cochineal insect or some of its allies are found on many other species of Opuntia. (For accounts of *Coccus Cacti*, and of the cochineal industry, see Melchior de la Ruusscher, *Natuerlyke historie van de Couchenille.* — Rutty, *Phil. Trans.* xxxvi. 264 [*The Natural History of Cochineal*]. — Thiery de Menonville, *Traité de la Culture du Nopal et de l'Education de la Cochenille dans les colonies françaises de l'Amérique.* — Francisco Hernandez, *Hist. Pl. Nov. Hisp.* ed. Madrid, 1790, ii. 177. — Staunton, *Account of the Embassy of the King of Great Britain to the Empire of China*, i. 186, Atlas, t. 12. — Humboldt, *Essai Pol. Nouv. Esp.* iii. 242. — Bancroft, *Philosophy of Permanent Colors*, i. 410. — Royle, *Essay on the Productive Resources of India*, 57. — Signoret, *Ann. Soc. Ent. France*, sér. 4, viii. 846 [*Essai sur les Cochenilles*]. — Vett, *Woordenbock van Nederlandsch-Indie Cochenille.* — Spons, *Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products*, i. 856. — Ober, *Travels in Mexico*, 529. —

Tuna,[1] *Opuntia Ficus-Indica*,[2] and of other species. The fruit of *Opuntia Ficus-Indica*, now naturalized in most warm dry regions, and of several other species is refreshing, and is consumed in considerable quantities in semitropical countries;[3] and *Opuntia Opuntia*,[4] which grows on the Atlantic coast from

Watt, *Dictionary of the Economic Products of India*, ii. 398. — Cockerell, *Am. Nat.* xxvii. 1041 [*Notes on the Cochineal Insect*].)

Since the introduction of aniline dyes cochineal has so depreciated in value that its production on a large scale is no longer profitable, and the industry has lost its commercial importance. (See A. S. Brown, *Social and Economical Condition of the Canary Islands*, 5, 24 [Parliament of Great Britain, *Sessional Papers*, lxxx. 1892, *Miscellaneous Series*, No. 246].)

[1] Miller, *Dict.* ed. 8, No. 3 (1768). — Haworth, *Syn. Pl. Succ.* 188. — De Candolle, *Prodr.* iii. 472. — Pfeiffer, *Enum. Cact.* 161. — Spach, *Hist. Vég.* xiii. 407, t. 46. — Salm-Dyck, *Cact. Hort. Dyck.* ed. 3, 66. — Grisebach, *Fl. Brit. W. Ind.* 302. — Willkomm & Lange, *Prodr. Fl. Hispan.* iii. 129. — Hemsley, *Bot. Biol. Am. Cent.* i. 554. — Coulter, *Contrib. U. S. Nat. Herb.* iii. 420. — Duss, *Ann. Inst. Col. Marseille*, iii. 318 (*Fl. Antilles Françaises*). — Schumann, *Monog. Cact.* 723. — Maiden, *Agric. Gazette New South Wales*, ix. 994, t.

Cactus Tuna, Linnæus, *Spec.* i. 468 (1753).

Cactus Opuntia Tuna, Tussac, *Fl. Med. Antilles*, ii. 213, t. 31 (1818).

Cactus Bonplandii, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* vi. 69 (1823). — Kunth, *Syn. Pl. Æquin.* iii. 372.

Opuntia horrida, De Candolle, *l. c.* iii. 472 (1823). — Pfeiffer, *l. c.* 162.

Opuntia Ficus-Indica, Webb & Berthelot, *Phytogr. Canar.* iii. pt. ii. sect. i. 208 (not Miller) (1836–40).

Opuntia Tuna, a native probably of some of the warmer parts of Central or South America, has become widely naturalized in most warm countries. One of the handsomest of the Opuntias, it is almost arborescent in habit, with a short stem, broad flat branches, stout yellow spines, and insipid fruit. It is this species which is perhaps most generally employed in hedges; and it is frequently cultivated in southern Florida, the West Indies, northern Mexico, Lower California, southern California, and many of the countries of Central and South America, in the Mediterranean basin, India, Australia, southern Africa, and the Canary Islands. Although the fruit is insipid, in the West Indies its juice is sometimes employed to give a scarlet color to liquors and to fruit used in confectionery. (See Fawcett, *Economic Plants, Jamaica*, 59.) Tuna, the specific name of this plant, is the common Spanish-American name of the fruits of all the flat-branched Opuntias.

[2] Miller, *l. c.* No. 2. — Haworth, *l. c.* 191. — De Candolle, *l. c.* iii. 473. — Pfeiffer, *l. c.* 152. — Salm-Dyck, *l. c.* 66, 235. — Chapman, *Fl.* 144. — Grisebach, *l. c.* 302. — Lowe, *Man. Fl. Mad.* 317. — Brandis, *Forest Fl. Brit. Ind.* 246. — Willkomm & Lange, *l. c.* 129. — Hemsley, *l. c.* i. 551. — Coulter, *l. c.* 419. — Schumann, *l. c.* 719. — Maiden, *l. c.* ix. 990.

Cactus Ficus-Indica, Linnæus, *Spec.* 468 (1753).

Cactus Opuntia subinermis, Tussac, *l. c.* ii. 220, t. 34 (1818).

Opuntia Tuna, Webb & Berthelot, *l. c.* 209 (not Miller) (1836–40).

Cactus Opuntia, Gussone, *Fl. Sicul. Prodr.* 559 (not Linnæus) (1827).

Opuntia vulgaris, Tenore, *Syll. Fl. Neap.* 239 (not Miller) (1831).

[3] The pulp of the fruit of the flat-leaved Opuntias is sweet and acidulous, and contains assimilable matter in the form of mucilage, albumen, and large quantities of sugar, and is free from all astringent and toxic properties. (See De Graffe, *Am. Jour. Pharm.* lxviii. 169, t.; also Light, *Am. Jour. Pharm.* lvi. 3 [*The Fruit of Opuntia vulgaris*]. — Maisch, *Am. Jour. Pharm.* lxiii. 2 [*Fruit of Opuntia*].) That of *Opuntia Ficus-Indica*, the so-called Indian Fig, which is extensively cultivated for its fruit in Mexico and other warm countries, is perhaps more esteemed than that of other species. It is often three or four inches long and two inches wide, and is yellow or orange-colored, more or less tinged with pink or red, and covered with small tufts of bristles, which are easily rubbed off. In northern Mexico it forms an important part of the food of the poor, being sold in immense quantities by street-venders during all the summer months. (See Palmer, *West American Scientist*, vi. 67.) It is also used as food in many parts of South America (see Hieronymus, *Pl. Diaph. Fl. Argent.* 128), and largely in Italy and the other countries bordering the Mediterranean. (See Varvaro, *Il Fico d'India in Sicilia.*)

The fruit of many other Opuntias is gathered and eaten by the North American Indians, especially by the tribes which inhabit the desert regions of the southwest. (See Newberry, *Popular Science Monthly*, xxxii. 37 [*Food and Fibre Plants of the North American Indians*].) By the Pawnees and Papigos it is gathered before it is fully ripe, allowed to dry, and used in cooking meat. The fresh unripe fruit is often boiled in water and then allowed to ferment, when it becomes stimulating as well as nutritious.

In Mexico, caloncbe, an intoxicating drink similar in taste to hard cider, is made from the fruit of several species of Opuntia by pressing out the juice, passing it through straw sieves, and heating it by fire or the sun, when it soon begins to ferment. (See Havard, *Bull. Torrey Bot. Club*, xxiii. 33 [*Drink Plants of the North American Indians*].)

[4] Coulter, *l. c.* 432 (1896). — Britton & Brown, *Ill. Fl.* ii. 463, f. 2527.

Cactus Opuntia, Linnæus, *l. c.* 468 (in part) (1753). — Walter, *Fl. Car.* 146. — Michaux, *Fl.* i. 282. — Persoon, *Syn.* ii. 22. — Pursh, *Fl. Am. Sept.* i. 327. — Nuttall, *Gen.* i. 296. — Elliott, *Sk.* i. 537. — Sims, *Bot. Mag.* l. t. 2393.

Opuntia vulgaris, Miller, *l. c.* No. 1 (1768); *Icon.* t. 191. — Haworth, *l. c.* 190. — De Candolle, *l. c.* iii. 474. — Pfeiffer, *l. c.* 149. — Salm-Dyck, *l. c.* 69. — Engelmann, *Proc. Am. Acad.* iii. 297. — Engelmann & J. M. Bigelow, *Pacific R. R. Rep.* iv. pt. v. 42, t. 10, f. 1, 2, t. 23, f. 13. — Chapman, *l. c.* 144. — Watson & Coulter, *Gray's Man.* ed. 6, 197. — Schumann, *l. c.* 714. — Maiden, *l. c.* ix. 992.

Cactus Opuntia vulgaris, De Candolle, *Pl. Grasses*, 138, t. (1779).

Opuntia maritima, Rafinesque, *Med. Fl.* ii. 247 (1830).

Opuntia Italica, Tenore, *l. c.* 241 (1831).

Opuntia intermedia, Salm-Dyck, *Cat. Hort. Dyck*, 364 (1834); *Cact. Hort. Dyck.* ed. 3, 69, 243. — Pfeiffer, *l. c.* 150.

Cactus nana, Visiani, *Fl. Dalm.* iii. 143 (1852).

Opuntia vulgaris, β *nana*, Schumann, *l. c.* 715 (1898).

Opuntia Opuntia, which grows on sandy and occasionally on rocky soil, usually only in the immediate neighborhood of the coast, from the island of Nantucket off the southern shore of Massachusetts to South Carolina, is a dwarf plant, with short procumbent flattened branches armed occasionally with a few small spines, and

Massachusetts to South Carolina, and *Opuntia Dillenii*[1] have been believed to possess valuable medical properties. The large-growing Opuntias with flat leaves are employed in many countries to form hedges for the protection of gardens and fields against browsing animals; and the branches of Opuntia, which are saturated with watery juices, are sometimes stripped of their spines and bristles and fed to cattle.[2]

Opuntia, which forms the principal food of a number of scale-insects, is not known to suffer from them or from serious fungal diseases.[3]

Opuntia, used by Theophrastus as the name for some plant which grew in the neighborhood of the city of Opus in Bœotia, was bestowed by Tournefort on the Prickly Pears of the New World.[4]

small yellow flowers. It is chiefly interesting as the most northern representative of the genus in eastern America. Rafinesque (*Med. Fl.* ii. 247) described the use of the split branches in the treatment of acute rheumatism and as a remedy for chronic ulcers, gout, and wounds, and stated that the juices and gummy exudations were used in the treatment of gravel. A tincture prepared from the fresh flowers and green ovaries is sometimes used in homœopathic practice. (See Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, i. 61, t. 61.)

In the southern states the quality of tallow candles has been sometimes improved by boiling the split branches of *Opuntia Opuntia* with the tallow, which is hardened by their juices. (See Porcher, *Resources of Southern Fields and Forests*, 66.)

Opuntia Opuntia is said to have been introduced into English gardens before the beginning of the sixteenth century (see Aiton, *Hort. Kew.* ii. 153), but it is not improbable that the early references to this plant apply to some West Indian or Mexican species and not to that of the Atlantic seaboard of the United States, which from its small size and comparative rarity might easily have escaped the notice of the first explorers of our coast. *Opuntia Opuntia*, or a dwarf species closely allied to it, is now naturalized in many of the countries of the Mediterranean basin. (See Brotero, *Fl. Lusitan.* ii. 245. — Visiani, *Fl. Dalm.* iii. 143. — Willkomm & Lange, *Prodr. Fl. Hispan.* iii. 128. — Caruel, *Parlatore Fl. Ital.* x. 143.)

In the region adjacent to the Rio Grande the flat branches of Opuntias are frequently used to poultice ulcers and sores of all kinds. The branch is first heated to remove the bristles and spines and to warm and soften the pulp; it is then opened through the middle or one of the surfaces is shaved off, and the exposed portion is applied to the part requiring treatment. Opuntia branches heated and mashed into pulp are employed in the same region to clarify water, and sometimes as food (see Havard, *Proc. U. S. Nat. Herb.* viii. 521); and on the Isthmus of Panama, where a species of Opuntia is often planted in hedges, the split branches are also believed to possess medical virtues. (See Seemann, *Bot. Voy. Herald*, 131.)

[1] *Opuntia Dillenii*, Haworth, *Suppl. Pl. Succ.* 79 (1819). — De Candolle, *Prodr.* iii. 472. — Pfeiffer, *Enum. Cact.* 162. — Wight & Arnott, *Prodr. Fl. Ind.* 363. — Wight, *Ill.* ii. t. 114. — Lowe, *Man. Fl. Mad.* 318. — Clarke, *Hooker* f. *Fl. Brit. Ind.* ii. 657. — Maiden, *Agric. Gazette New South Wales*, ix. 1002.

Cactus Dillenii, Kerr, *Bot. Reg.* iii. t. 255 (1817).

Cactus Indicus, Roxburgh, *Fl. Ind.* ed. 2, ii. 475 (1832).

Opuntia Tuna, Schumann, *Monog. Cact.* 724 (in part) (not Miller) (1898).

Opuntia Dillenii, which is believed to be indigenous in tropical America, has become widely naturalized in India, extending to Jhelan in the northwest and ascending the Himalayas to elevations of five thousand feet above the sea-level. It has been largely used as a hedge plant. The fruit is esteemed as a refrigerant; the crushed branches are used as poultices to reduce heat and inflammation; a syrup prepared from the fruit is employed in the treatment of whooping-cough to increase the secretion of bile and to control spasmodic coughing and expectoration. The juice has been successfully employed as a purgative and as a demulcent in the treatment of gonorrhœa, and the pulp of the crushed branches to relieve ophthalmia. (See Brandis, *Forest Fl. Brit. Ind.* 245. — Watt, *Dictionary of the Economic Products of India*, v. 490.)

[2] See Havard, *l. c.* — MacOwan, *Kew Bull. Miscellaneous Information*, July, 1888, 167. — Bourde, *Revue Tunisienne*, 1894 (*Projet d'Enquête sur le Cactus considéré comme Plante Fourragère*). — Maiden, *l. c.* vii. 651. — Boyce, *Agric. Gazette New South Wales*, viii. 260, 504. — Gennadius, *Agric. Gazette New South Wales*, ix. 38 (*The Prickly Pear in Cyprus*).

[3] Little can be said with regard to the fungi which attack the larger species of Opuntia in this country. *Sphæria Cacti*, Schweinitz, which forms black spots arranged in groups on the leaves, is probably common on several species, but its botanical characters are not well understood. *Teichospora Opuntiæ*, Ellis & Everhart, a small Pyrenomycete, attacks *Opuntia arborescens*, and *Glœosporium Opuntiæ*, Ellis & Everhart, has been found on *Opuntia Brasiliensis*, Haworth, in the United States. A peculiar morbid growth on Opuntia and other Cactaceæ has been described by Sorauer (*Monat. Kakt.* vii. 1). It is due, however, not to the action of fungi but to the successive formation of corky tissue.

[4] *Inst.* i. 239, t. 122.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

CYLINDROPUNTIA.

Joints of the branches cylindrical, tuberculate, with reticulated ligneous skeletons; spines inclosed in loose sheaths; fruit fleshy, setulose, or occasionally spinescent; seeds marginless, marked by a conspicuous narrow marginal commissure.

Tubercles of the branches full and rounded below the areolæ.

Joints pale olive-colored, easily separable, their tubercles broad, mamillate; spines yellow; flowers pink; fruit proliferous, usually spineless, often sterile . . . . . 1. O. FULGIDA.

Joints green or purple, their tubercles narrow, ovate; spines white to reddish brown; flowers purple; fruit yellow, sparingly spinescent, rarely proliferous . . . . . 2. O. SPINOSIOR.

Tubercles of the branches not full and rounded below the areolæ.

Joints elongated, dark green, or purple, their tubercles elongated; spines brown or reddish brown; flowers green, tinted with red or yellow; fruit green, spinescent, rarely proliferous . . . . . 3. O. VERSICOLOR.

OPUNTIA FULGIDA.

Cholla.

JOINTS of the branches pale olive-colored, easily separable, their tubercles broad, mamillate, full and rounded below the areolæ; spines yellow. Flowers pink. Fruit dull green, proliferous, usually spineless.

Opuntia fulgida, Engelmann, *Proc. Am. Acad.* iii. 306 (1856); *Bot. Mex. Bound. Surv.* ii. 57, t. 75, f. 18; *Wheeler's Rep.* vi. 131. — Walpers, *Ann.* v. 56. — Hemsley, *Bot. Biol. Am. Cent.* i. 551. — Toumey, *Garden and Forest*, viii. 324, f. 46; *Bot. Gazette*, xxv. 119. — Coulter, *Contrib. U. S. Nat. Herb.* iii. 448. — Schumann, *Monog. Cact.* 676.

Opuntia fulgens, Engelmann, *Brewer & Watson Bot. Cal.* i. 250 (1876).

A tree, with a more or less flexuous trunk occasionally twelve feet in height and sometimes a foot in diameter, a symmetrical head of stout wide-spreading branches,[1] and thick pendulous joints which are sometimes almost hidden by their long conspicuous spines and which begin to develop their woody skeletons during their second or occasionally not until their third season. The bark of the trunk and of the large limbs is about a quarter of an inch in thickness and separates freely on the surface into large thin loosely attached scales which vary in color from dark yellow-brown to nearly black on the largest stems, and is nearly destitute of spines which mostly fall with the outer layers when the branches are from three to four inches in thickness. The terminal or ultimate joints of the branches are ovate or ovate-cylindrical, tumid, crowded at the ends of the limbs, pale olive-colored, from three to eight inches long and often two inches in diameter; their tubercles are ovate-oblong, broad, and from one half to three quarters of an inch in length, with areolæ of pale straw-colored matted tomentum, and short slender pale bristles; when they first appear each areola bears from five to fifteen stout stellate-spreading light yellow spines of nearly equal length, from three quarters of an inch to an inch long, and inclosed in loose lustrous sheaths; during succeeding years additional spines develop at the upper margins of the areolæ, and tubercles on old branches are sometimes furnished with from forty to sixty spines which remain on the branches from four to six years. The leaves are light green, from one half of an inch to nearly an inch in length, and taper gradually to the acuminate apex. The flowers appear from June to September, the first being produced from tubercles at the ends of the branches of the previous year, the later from the terminal tubercles of the immature fruit developed from the earliest flowers of the season. They are an inch in diameter when fully expanded, with ovaries nearly an inch long, from eight to ten orbicular obtuse crenulate sepals, five erect stigmas, and eight light pink petals,[2] those of the outer ranks being cuneate, retuse, crenulate on the margins, and shorter than those of the inner ranks, which are lanceolate and acute, the whole corolla becoming strongly reflexed at maturity. The fruit, which is proliferous, hangs in pendulous clusters usually with six or seven fruits, and occasionally with forty or fifty, in a cluster, one growing from the other in continuous succession, the first of the cluster being the largest and containing perfect seeds while the

[1] "I suspect that the long surface roots enable these plants to get their moisture from the rains which seldom penetrate the soil to a greater depth than from six to twelve inches. I have never seen tuberous enlargements on the fibrous roots." (Toumey, *in litt.*)

[2] The plant of Lower California which is believed to be of this species is said to have yellow petals. (See K. Brandegee, *Erythea*, v. 122 [*Notes on Cacteæ*].)

In the early descriptions of this species the petals were said to be purple, but according to Professor Toumey, who has had the best opportunity of studying the Cacti of Arizona and adjacent regions, and to whom I am indebted for my knowledge of these tree Opuntias, they are purple only after they are dried.

secondary fruits are frequently sterile; it is dull green when fully ripe, with dry flesh, and falls usually during the first winter, although occasionally a fruit remains on the branches during a second season and develops flowers from its tubercles; the fruit is oval, rounded, and from an inch to an inch and a quarter in length, nearly as broad as it is long, more or less tuberculate,[1] conspicuously marked with large pale tomentose areolæ bearing numerous small bristles and, although usually spineless, occasionally small weak spines. The seeds are compressed, thin, very angular, and from one twelfth to one sixth of an inch in diameter.[2]

Opuntia fulgida, which is a plant of the plains, and is not rare in Arizona south of the Colorado plateau and in the adjacent region of Sonora, apparently is most abundant and grows to its largest size on the mesas near Tucson, at elevations between two thousand and three thousand feet above the level of the sea. It is said to grow also at Cottonwood Springs in southern Nevada and at Calamuget, and on Magdalena Island in Lower California.

The wood of old trunks, which contains a thick pith, is light, hard, and pale yellow, with broad conspicuous medullary rays and well marked layers of annual growth.[3]

This Cactus, the Vera de Coyote of the Mexican Indians, was first made known to science by the botanists attached to the commission which defined the boundary between the United States and Mexico. It is one of the most conspicuous and interesting plants of the mesas of southern Arizona, where in the clear atmosphere of the desert the lustrous sheaths inclosing its numerous spines glistening in the sunlight make it visible for many miles.

[1] The depth of the tubercles on many of the cylindrical Opuntias, especially on the mature or nearly mature fruit, depends almost entirely on the amount of moisture. During exceedingly dry seasons the tubercles are deep and the fruit small and shriveled. On the same plants during a moist season the fruit is large and plump, and the tubercles are scarcely raised above the remainder of the surface. This is true, only not to so great a degree, of the younger branches of the plant itself. (Toumey, *in litt.*)

[2] On the foothills of the mountain ranges of southern Arizona and northern Sonora a form of this plant occurs with thicker shorter joints, more prominent but shorter tubercles, and fewer spines, usually only from four to six spines being developed from the tubercles of the terminal joints, although from those of older joints as many as twenty or thirty are produced. The flowers and fruit of the two forms appear to be identical, but the foothill variety is a smaller plant than that of the mesas. It is:—

Opuntia fulgida mamillata, Coulter, *Contrib. U. S. Nat. Herb.* iii. 449 (1896). — Toumey, *Bot. Gazette*, xxv. 121.

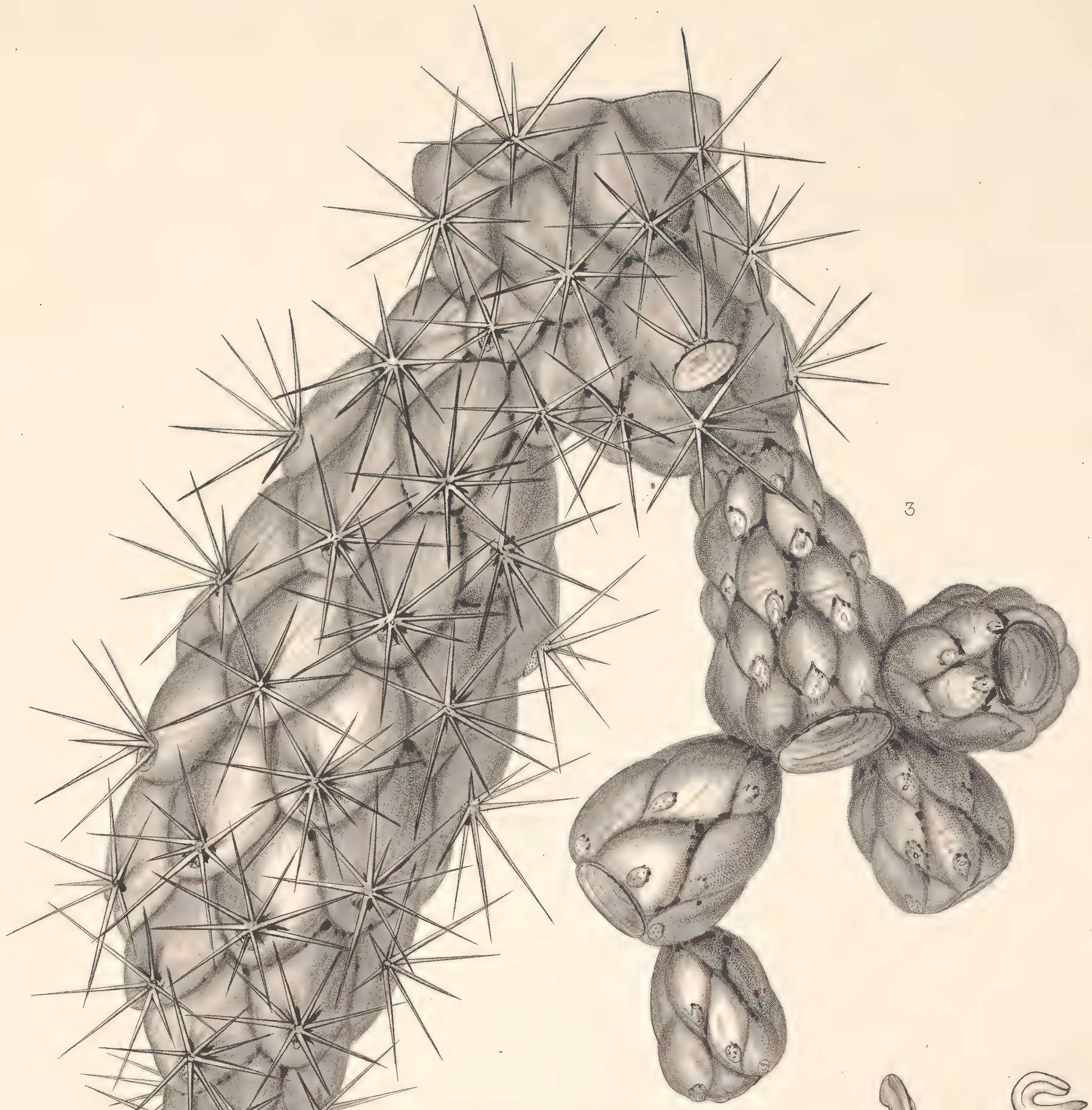
Opuntia mamillata, Engelmann, *Proc. Am. Acad.* iii. 308 (1856); *Bot. Mex. Bound. Surv.* ii. 58, t. 75, f. 19; *Brewer & Watson Bot. Cal.* i. 250. — Walpers, *Ann.* v. 57. — Hemsley, *Bot. Biol. Am. Cent.* i. 552. — Toumey, *Garden and Forest*, viii. 325.

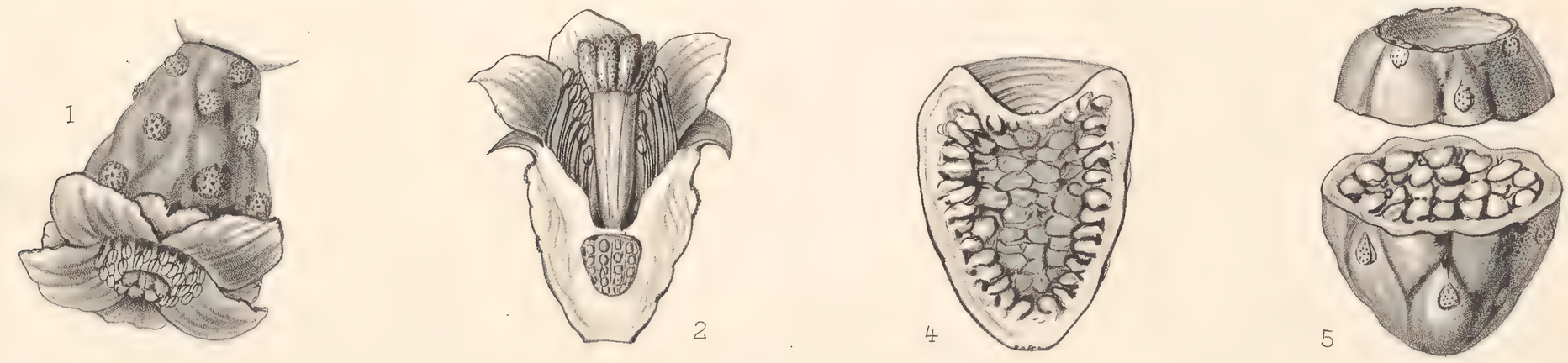
[3] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, cut by Professor Toumey in the neighborhood of Tucson, is seven inches in diameter inside the bark, with fourteen layers of annual growth in the solid exterior layer of wood, which is about two and a half inches in thickness.

EXPLANATION OF THE PLATE.

Plate DCCVI. Opuntia fulgida.

1. A flower, natural size.
2. Vertical section of a flower, natural size.
3. End of a fruiting branch, natural size.
4. Vertical section of a fruit, natural size.
5. A fruit laid open transversely, natural size.
6. A seed, enlarged.
7. A seed showing raphe, enlarged.
8. Cross section of a seed, enlarged.
9. An embryo, enlarged.





C.E.Faxon del. *Em.Himely sc.*

OPUNTIA FULGIDA, Engelm.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

OPUNTIA SPINOSIOR.

Tassajo.

JOINTS of the branches green or purple, their tubercles ovate, narrow, full, and rounded below the areolæ; spines white or reddish brown. Flowers pink. Fruit yellow, sparingly spinescent, rarely proliferous.

Opuntia spinosior, Toumey, *Bot. Gazette*, xxv. 119 (1898).

Opuntia Whipplei, β spinosior, Engelmann, *Proc. Am. Acad.* iii. 307 (1856); *Pacific R. R. Rep.* iv. pt. v. 51, t. 17, f. 1–4; *Bot. Mex. Bound. Surv.* ii. 57. — Hemsley, *Bot. Biol. Am. Cent.* i. 554. — Coulter, *Contrib. U. S. Nat. Herb.* iii. 451. — Schumann, *Monog. Cact.* 670.

Opuntia arborescens, Engelmann, *Pacific R. R. Rep.* iv. 51, pt. v. t. 17, f. 5, 6 (not Engelmann, *Wislizenus Memoir of a Tour to Northern Mexico* [*Senate Doc.* 1848], Bot. Appx. 6). — Toumey, *Garden and Forest*, ix. 2, f. 1.

A tree, with an erect trunk occasionally ten feet in height and from five to ten inches in diameter, and numerous stout vertically spreading branches which form an open irregular head. The bark of the trunk and of the large limbs is about a quarter of an inch in thickness, spineless, nearly black, broken into elongated ridges, and finally much roughened by numerous thin closely appressed scales. The joints of the branches are cylindrical, from four to twelve inches in length and from three quarters of an inch to an inch in thickness, covered with a thick epidermis which varies in color from green to purple, and usually develop woody skeletons during their second season; their tubercles are prominent, compressed, ovate, and from one third to one half of an inch long, with oval areolæ clothed with pale tomentum and short light brown bristles; their spines, which vary in number from five to fifteen on the tubercles of young joints and from thirty to fifty on those of older branches, are slender, from white to light reddish brown in color, closely invested in white glistening sheaths, stellate-spreading, and from one half to three quarters of an inch in length, those in the interior being sometimes considerably longer than the radical spines. The leaves are terete, about a quarter of an inch long, and taper gradually to the setulose apex; they remain on the branches from four to six weeks. The flowers, which unfold during April and May, remain open for two or three days, and appear to depend on the visits of bees and other insects for fertilization;[1] they are from two to two and a half inches in diameter when fully expanded, with ovaries about an inch in length, obovate sepals, broadly obovate dark purple petals, sensitive red stamens,[2] and six to nine-parted stigmas. The yellow fleshy acrid fruits are clustered at the ends of the branches of the previous year, and when ripe make them pendulous by their weight; they are oval or rarely globose or hemispherical, and frequently two inches long and an inch and a half thick, with from twenty to thirty tubercles; during the summer these are very prominent, but as the fruits ripen they enlarge and become succulent and the tubercles nearly disappear, leaving the fruits marked only by the small oval areolæ covered with short bristles and armed with numerous slender spines, which are deciduous in December as the fruits begin to turn yellow. The seeds vary from one fifth to one sixth of an inch in diameter and are nearly orbicular, slightly or not at all beaked, and

[1] "These insects, attracted to the flower, enter between the style and stamens, passing down to the base of the style to get the nectar. The numerous sensitive stamens immediately bend forward toward the style, closing over the insect and hiding it from view. It necessitates quite an effort on the part of the insect to escape, but it finally forces its way from beneath the stamens and climbs to the top of the elongated stigma, whence it makes its escape, thoroughly dusted with the pollen from the numerous stamens. In a few minutes the stamens assume their normal condition and the flower is ready for the reception of other insects. I have frequently seen as many as three honeybees inclosed in a single flower." (Toumey, *Garden and Forest*, ix. 3.)

[2] Professor Toumey points out the facts that the stamens of all the Opuntias with cylindrical branches are sensitive, and that when disturbed they close tightly round the style a few lines below the stigma. (See *Bot. Gazette*, xxv. 123.)

marked with linear conspicuous commissures. The fruits remain on the branches during the winter and occasionally during the following summer, and then sometimes become proliferous, bearing flowers and fruits.[1]

Opuntia spinosior is widely scattered over the mesas of southern Arizona south of the Colorado plateau and over the adjacent region of Sonora.

The wood of *Opuntia spinosior* is light, soft, pale reddish brown, and conspicuously reticulated with inconspicuous medullary rays and well-defined layers of annual growth.[2] It is sometimes used in the manufacture of light furniture, canes, picture-frames, and other small articles.

Opuntia spinosior was discovered in Sonora in 1855 by Mr. A. Schott.[3]

[1] Professor Toumey recognizes as var. *Neo-Mexicana* (*Bot. Gazette*, xxv. 119 [1898]) a variety of this species which grows with the ordinary form to the same size but is distinguished from it by longer tubercles, more numerous spines with looser sheaths, flowers with more numerous and much narrower petals varying in color from red to yellow, and larger fruits often more or less tinged with red.

[2] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is five and a half inches in diameter inside the bark, with seventy-two layers of annual growth in the outer woody portion, which is two and one sixteenth inches in thickness.

[3] See x. 18.

EXPLANATION OF THE PLATE.

PLATE DCCVII. OPUNTIA SPINOSIOR.

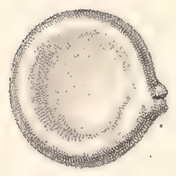
1. A flower, natural size.
2. Vertical section of a flower, natural size.
3. The end of a fruiting branch, natural size.
4. Vertical section of a fruit, natural size.
5. A fruit divided transversely, enlarged.
6. A seed, enlarged.
7. A seed showing the raphe, enlarged.
8. Vertical section of a seed, enlarged.
9. An embryo, enlarged.

1

3

9

6



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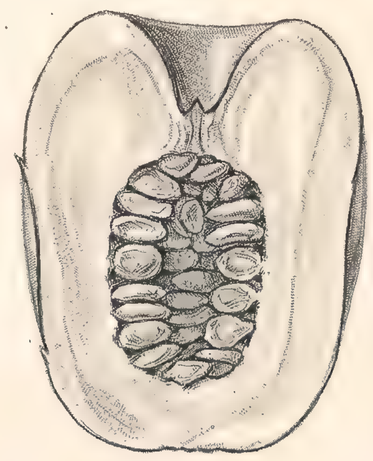

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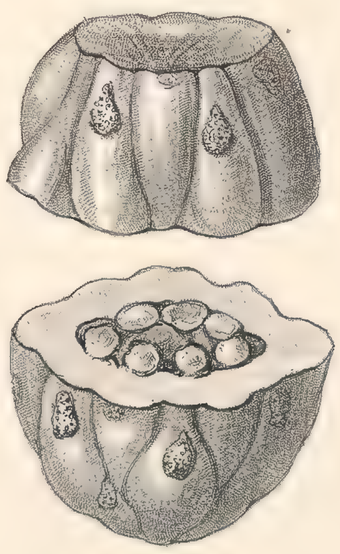


C.E.Faxon del.

Rapine sc.

OPUNTIA SPINOSIOR, Toum.

A.Riocreux direx.t

Imp.J.Taneur, Paris.

OPUNTIA VERSICOLOR.

JOINTS of the branches dark green or purple, elongated, their tubercles flattened, elongated; spines brown or reddish brown. Flowers green tinged with red or yellow. Fruit green, spinescent, rarely proliferous.

Opuntia versicolor, Coulter, *Contrib. U. S. Nat. Herb.* iii. 452 (1896). — Toumey, *Bot. Gazette*, xxv. 121. — Schumann, *Monog. Cact.* 674.

A tree, with an erect trunk occasionally in well-developed specimens six or eight feet high and eight inches in diameter, and numerous stout irregularly spreading often upright branches. The bark of the trunk and of the large branches is smooth, light brown or purple, usually unarmed, from one half to three quarters of an inch in thickness, and ultimately separates into numerous small closely appressed nearly black scales. The terminal joints of the branches are cylindrical, generally from six to twelve inches but sometimes two feet in length, and from three quarters of an inch to nearly an inch in diameter; their woody skeletons are usually formed during their second season, and they are covered with a thick epidermis which varies from dark green to purple, and is marked by linear flattened tubercles terminating in large oval areolæ which are clothed with gray wool and generally bear a cluster of small bristles; their spines are slender, stellate-spreading, the inner from one to four in number, usually deflexed and unequal in length, the longest being about one third of an inch long and much longer than the radiant spines; they are brown or reddish brown, with close early deciduous straw-colored sheaths, and vary on young joints from four to fourteen in number, while the tubercles of old branches often bear from twenty to twenty-five. The leaves are terete, from one third to one half of an inch in length, abruptly narrowed to the spinescent apex, and remain on the branches from four to six weeks. The flowers open in May, and when fully expanded are about an inch and a half in diameter, with ovaries five eighths of an inch long, broadly ovate acute sepals, and narrow obovate petals rounded above and green tinged with red or with yellow. The fruit is usually clavate, from two inches to two inches and a half in length and nearly an inch and a half in diameter, with areolæ generally only above the middle and usually furnished with from one to three slender reflexed persistent spines about half an inch long, or occasionally spineless; rarely the fruit is nearly spherical and only about three quarters of an inch in diameter. When mature the fruit is of the same color as the joints on which it grows and ripens from December to February; usually it withers and dries on the tree and frequently splitting open shows the irregular angled seeds with their narrow commissures. In some cases it does not wither during the first winter, but remains fleshy and adheres to the branch until the end of the following summer and sometimes through a second winter; or often it is imbedded in the end of a more or less elongated joint.

Opuntia versicolor is the most abundant of the cylindrical Opuntias of the foothills and low mountain slopes of southern Arizona and northern Sonora, although it does not appear to have attracted the attention of botanists until 1880, when it was found in the neighborhood of Tucson by George Engelmann [1] and C. C. Parry.[2]

The wood of *Opuntia versicolor* is reticulate, hard, compact, light reddish brown and rather lustrous, with thin conspicuous medullary rays, well-determined layers of annual growth, and thick pale or nearly white sapwood.[3]

[1] See viii. 84. [2] See vii. 130.

[3] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, which was cut by Professor Toumey in southern Arizona on the foothills of the Santa Catalina Mountains near Sabina Cañon, is five and seven eighths inches in diameter inside the bark, with seventy-nine layers of annual growth; of these twenty-eight are of sapwood, which is three quarters of an inch in thickness.

EXPLANATION OF THE PLATE.

PLATE DCCVIII. OPUNTIA VERSICOLOR.

1. The end of a flowering branch, natural size.
2. Vertical section of a flower, natural size.
3. The end of a fruiting branch, natural size.
4. Vertical section of a fruit, natural size.
5. A seed, enlarged.
6. Vertical section of a seed, enlarged.
7. An embryo, enlarged.

1

3

2

7

5

6

4

C.E.Faxon del.

Rapine sc.

OPUNTIA VERSICOLOR, Coult.

A.Riocreux dirext.

Imp. J.Taneur, Paris.

CORNUS ASPERIFOLIA.

Dogwood.

LEAVES oblong-ovate, acute, scabrous on the upper surface.

Cornus asperifolia, Michaux, *Fl. Bor.-Am.* i. 93 (1803). — *Nouveau Duhamel*, ii. 156. — Poiret, *Lamarck Dict.* Suppl. ii. 356. — Pursh, *Fl. Am. Sept.* i. 108. — Elliott, *Sk.* i. 209. — Roemer & Schultes, *Syst.* iii. 322. — Sprengel, *Syst.* i. 451. — Torrey & Gray, *Fl. N. Am.* i. 651. — Rafinesque, *Alsograph. Am.* 61. — Chapman, *Fl.* 167. — K. Koch, *Dendr.* i. 692. — Watson & Coulter, *Gray's Man.* ed. 6, 214. — Coulter & Evans, *Bot. Gazette*, xv. 35. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 150 (*Man. Pl. W. Texas*). — Koehne, *Deutsche Dendr.* 437. — Dippel, *Handb. Laubholzk.* iii. 253, f. 135. — Sargent, *Garden and Forest*, x. 104, f. 13. — Britton & Brown, *Ill. Fl.* ii. 544, f. 2715. — Britton, *Man.* 690. — Gattinger, *Fl. Tennessee*, 130.

Cornus sericea, γ **asperifolia**, De Candolle, *Prodr.* iv. 272 (1830). — Don, *Gen. Syst.* iii. 399. — Loudon, *Arb. Brit.* ii. 1013.

Cornus alba, Hooker, *Compan. Bot. Mag.* i. 48 (not Linnæus) (1835).

Cornus Drummondi, C. A. Meyer, *Bull. Phys. Math. Acad. St. Pétersbourg*, iii. 372 (1845); *Ann. Sci. Nat.* sér. 3, iv. 64. — Walpers, *Rep.* v. 933.

Cornus asperifolia, var. **Drummondi**, Coulter & Evans, *Bot. Gazette*, xv. 36 (1890). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 151 (*Man. Pl. W. Texas*). — Koehne, *Deutsche Dendr.* 437.

Usually shrubby in habit, *Cornus asperifolia* on the rich bottom-lands of southern Arkansas and eastern Texas is frequently a tree sometimes nearly fifty feet in height, with a short trunk eight or ten inches in diameter, and slender erect wand-like branches forming a narrow irregular rather open head.[1] The bark of the trunk is about an eighth of an inch in thickness and is divided by shallow fissures into narrow interrupted ridges, and broken into small closely appressed dark red-brown scales. The branchlets are slender, marked by numerous small pale lenticels, pale green and puberulous when they first appear, pale red, lustrous and puberulous during their first winter, light reddish brown in their second year, and ultimately light gray-brown or gray. The winter-buds are acute, compressed, pubescent, sessile or stalked, about an eighth of an inch long, with two pairs of opposite scales, and about twice as large as the much compressed lateral buds. The leaves are opposite, involute in vernation, ovate or oblong, gradually or abruptly contracted at the apex into long slender points, gradually narrowed and rounded or cuneate at the base, and slightly thickened and undulate on the margins; when they unfold they are coated with lustrous silver-white tomentum, and nearly fully grown when the flowers open from the middle of May in Texas to the middle of July at the north, they are then dark green and roughened above by short rigid white hairs, and pale often glaucous and rough-pubescent below; and in the autumn they are membranaceous, scabrous on the upper surface, pubescent or puberulous on the lower surface, from three to four inches long and from an inch and a half to two inches wide, with thin midribs and from four to six pairs of slender primary veins nearly parallel with their sides, and stout grooved pubescent petioles usually about half an inch in length. The flowers are produced on slender pedicels in loose broad or narrow often paniculate pubescent cymes raised on peduncles frequently an inch in length; they are cream color, with an oblong cup-shaped obscurely toothed calyx covered with fine silky white hairs and narrow oblong acute corolla lobes about an eighth of an inch long and reflexed after the flowers open, elongated slender filaments with nodding anthers, and a columnar style thickened at the apex into the prominent stigma. The fruit is borne in

[1] The tree only twenty years old, cut by Mr. B. F. Bush near Columbia on the Brazos River in Texas in 1901 for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, was forty-five feet high, with a trunk seven inches in diameter.

loose spreading red-stemmed clusters, and ripens from the end of August until October; it is subglobose, white, tipped with the remnants of the style, and about a quarter of an inch in diameter. The nutlets, which are covered with a thin coat of dry bitter flesh, are full and rounded, broader than high, somewhat oblique, and slightly grooved on the edge.[1]

The wood of *Cornus asperifolia* is close-grained, hard, solid, and pale brown, with thick cream-colored sapwood.

Cornus asperifolia is distributed from the northern shores of Lake Erie, where it is abundant on Point Pelee,[2] to Minnesota,[3] eastern Nebraska [4] and Kansas,[5] and through Missouri and the Indian Territory to eastern Texas, and to Mississippi, Alabama,[6] South Carolina, and Florida.

Cornus asperifolia, although it was discovered by the elder Michaux more than a century ago, is still rare in gardens. It was introduced into the Arnold Arboretum in 1884, and is perfectly hardy in eastern Massachusetts.

[1] The size and shape of the nutlet have been used to separate the trans-Mississippi plant as a variety of the eastern species (Coulter & Evans, *Bot. Gazette*, xv. 36). In Arkansas and Texas the nut is sometimes rather smaller and broader in proportion to its height than it is usually in the fruit of eastern plants, but the nuts vary so much in size and shape that it is hardly practicable to base varietal characters on them.

[2] Macoun, *Cat. Can. Pl.* 191.

[3] MacMillan, *Metaspermæ of the Minnesota Valley*, 400.

[4] Bessey, *Bull. Exper. Stat. Nebraska*, iv. art. iv. 15.

[5] Hitchcock, *Flora of Kansas*, plate xiii.

[6] Mohr, *Contrib. U. S. Nat. Herb.* vi. 650 (*Plant Life of Alabama*).

EXPLANATION OF THE PLATE.

PLATE DCCIX. CORNUS ASPERIFOLIA.

1. A flowering branch, natural size.
2. Vertical section of a flower, enlarged.
3. A fruiting branch, natural size.
4. A nutlet, enlarged.

C.E. Faxon direx.t *Lartaud sc.*

CORNUS ASPERIFOLIA, Michx.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

VIBURNUM RUFIDULUM.

Black Haw.

LEAVES elliptical-ovate or elliptical-obovate, their petioles winged. Winter-buds short-pointed, ferrugineo-tomentose.

Viburnum rufidulum, Rafinesque, *Alsograph. Am.* 56 (1838).

Viburnum prunifolium, β ferrugineum, Torrey & Gray, *Fl. N. Am.* ii. 15 (not *Viburnum ferrugineum*, Rafinesque) (1841).

Viburnum prunifolium, Chapman, *Fl.* 171 (not Linnæus) (1860). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 94 (in part); *Silva N. Am.* v. 99 (in part), t. 225, f. 11. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 156 (*Man. Pl. W. Texas*).

Viburnum ferrugineum, Small, *Mem. Torrey Bot. Club*, iv. 123, t. 78 (not Rafinesque) (1894); *Bull. Torrey Bot. Club*, xxi. 306. — Britton, *Mem. Torrey Bot. Club*, v. 305.

Viburnum rufotomentosum, Small, *Bull. Torrey Bot. Club*, xxiii. 410 (1896). — Britton & Brown, *Ill. Fl.* iii. 233, f. 3446. — Mohr, *Contrib. U. S. Nat. Herb.* vi. 743 (*Plant Life of Alabama*). — Britton, *Man.* 872. — Gattinger, *Fl. Tennessee*, 156.

A tree, often forty feet in height, with a trunk from twelve to eighteen inches in diameter, and short thick branches forming an open irregular head. The bark of the trunk is from one quarter to one half of an inch in thickness and is separated into narrow rounded ridges divided by numerous cross fissures and roughened by small plate-like dark brown scales tinged with red. The branchlets are stout and marked by numerous small red-brown or orange lenticels, and when they first appear are more or less coated with ferrugineous tomentum, which also clothes the obtuse winter-buds, the wings of the petioles, and the lower surface of the unfolding leaves; during their first winter they are ashy gray, dark dull red-brown in their second season, and then gradually grow darker. The leaves are elliptical-ovate or elliptical-obovate, rounded, occasionally acute or obtuse at the short-pointed apex, rounded or wedge-shaped at the base, finely serrate, with slender apiculate straight or incurved teeth, coriaceous, dark green and very lustrous on the upper surface, and pale and dull on the lower surface; they are usually about three inches long and from three quarters of an inch to an inch and a half wide, with stout yellow midribs, numerous slender primary veins and reticulate veinlets more or less covered below throughout the season with the rufous tomentum which is also occasionally found on the upper side of the midribs and which is characteristic of this species; they are borne on stout grooved petioles which vary from one half to three quarters of an inch in length, and are margined with broad or narrow wings. The inflorescence buds are broadly ovate, full and rounded at the base, abruptly narrowed above and short-pointed and obtuse at the apex, compressed, often half an inch long and a third of an inch wide, with four pairs of boat-shaped scales coated on the outer surface with ferrugineous tomentum. The flowers are produced in compound sessile or stalked three to five but usually four-rayed thick-stemmed ferrugineo-pubescent corymbs often five or six inches in diameter, with minute subulate bracts and bractlets. The calyx is obconic, with short rounded lobes, and the corolla is creamy white and often a quarter of an inch in diameter when expanded, with orbicular or oblong rounded lobes. The stamens with slender filaments and light yellow anthers, are exserted, and the style is thick, conical, and terminated by a broad stigma. The fruit ripens in October, and is borne in few-fruited drooping red-stemmed clusters; it is oblong or slightly obovate, bright blue covered with a glaucous bloom, and about half an inch long. The stone is corneous, much compressed, and concave.[1]

[1] The description of *Viburnum prunifolium* in the fifth volume of this work was made to include this southern tree. The shape and tomentose covering of its winter-buds, the larger and more coriaceous leaves with more or less broadly winged ferrugineo-tomentose

Viburnum rufidulum inhabits dry upland woods and the margins of river bottom-lands, and is distributed from southwestern Virginia [1] and southern Illinois [2] to Hernando County, Florida, southeastern Kansas,[3] and the valley of the Guadaloupe River, Texas. One of the common and most beautiful of the small trees of the southern forests, which it enlivens in early spring with its great clusters of flowers and lustrous leaves, *Viburnum rufidulum* is most abundant, and attains its largest size in southern Arkansas, western Louisiana, and eastern Texas.

Viburnum rufidulum was introduced into the Arnold Arboretum from Missouri in 1883, and has proved perfectly hardy in eastern Massachusetts.

petioles, the wider flower-clusters and the odor of the freshly cut wood which is similar to that of the wood of *Viburnum Lentago*, are now known to be constant characters, and make it desirable to treat *Viburnum rufidulum* as a species. The range of the two trees is quite different. *Viburnum prunifolium* is northern, reaching the southern limits of its range in the foothill region of western North Carolina and in central Missouri, and southward is entirely replaced by *Viburnum rufidulum*, which is the only arborescent Viburnum of the low country of the south Atlantic and eastern Gulf states, and of Texas, Louisiana, Arkansas, the Indian Territory, and southern Missouri.

[1] The Pinnacle, Lee County, J. K. Small, July 27, 1892.

[2] G. H. French, Jackson County, June, 1878.

[3] *Viburnum rufidulum* has been collected in Cherokee County, Kansas, by G. L. Clothier and H. N. Whitford. (Teste *Herb. Gray*.)

EXPLANATION OF THE PLATE.

PLATE DCCX. VIBURNUM RUFIDULUM.

1. A flowering branch, natural size.
2. Vertical section of a flower, enlarged.
3. A fruiting branch, natural size.
4. A fruit divided transversely, enlarged.
5. A stone, enlarged.
6. A winter branchlet, natural size.
7. A winter branchlet of *Viburnum prunifolium*, natural size.

C.E.Faxon del. *Rapine sc.*

VIBURNUM RUFIDULUM, Raf.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

CEPHALANTHUS.

FLOWERS perfect; calyx unequally 4 or 5-toothed or lobed; corolla gamopetalous, 4-lobed, the lobes imbricated in æstivation; stamens 4; ovary inferior, 2-celled; ovule solitary, pendulous. Fruit obpyramidal, 2-coccous; seeds arillate. Leaves opposite or verticillate, petiolate, stipulate.

Cephalanthus, Linnæus, *Gen.* 61 (1737). — Adanson, *Fam. Pl.* ii. 147. — A. L. de Jussieu, *Gen.* 209; *Mém. Mus.* vi. 402. — A. Richard, *Mém. Soc. Nat. Paris*, v. 155. — Endlicher, *Gen.* 530. — Meisner, *Gen.* 170. — Bentham & Hooker, *Gen.* ii. 30. — Baillon, *Hist. Pl.* vii. 494. — Schumann, *Engler & Prantl Pflanzenfam.* iv. pt. iv. 59.

Small trees or shrubs. Leaves opposite or in verticils of threes, petiolate; stipules triangular or ovate, interpetiolar, deciduous, or persistent. Flowers nectariferous, yellow or creamy white, sessile in the axils of glandular bracts, in dense globose pedunculate terminal or axillary solitary or panicled heads. Receptacle globose, setose. Calyx-tube obpyramidal, the short limb unequally four or five-toothed or lobed. Corolla tubular funnel-form or saucer-shaped, divided into four or five short spreading or reflexed lobes, usually furnished with a minute dark gland at the base or on the side of each sinus, glabrous or puberulous on the inner surface of the tube. Stamens four, inserted on the throat of the corolla; filaments short; anthers linear-oblong, sagittate, apiculate at the base, attached on the back below the middle, two-celled, the cells opening longitudinally. Disk thin or obscure, or annular and fleshy. Ovary bicarpellate, two-celled; style filiform, elongated; stigma clavate, entire or slightly bilobed; ovules solitary, suspended from the apex of the cell on a short thickened papillose funicle, anatropous; raphe ventral; micropyle superior. Fruit obpyramidal, coriaceous, dicoccous. Seeds oblong, pendulous, covered at the apex by white spongy arils; testa membranaceous. Embryo straight, in cartilaginous albumen; cotyledons linear-oblong, obtuse; radicle elongated, superior.

Five species of Cephalanthus are now recognized. One is widely spread over the temperate and warmer parts of North America and reaches the Antilles; three species occur in South America from Uruguay to eastern Peru;[1] and one species[2] is distributed from the Sikkim Himalaya to China and the Malay peninsula and archipelago.

Only the North American species is known to possess useful properties.

The generic name, from κεφαλή and ἄνθος relates to the capitate inflorescence.

[1] Schumann, *Martius Fl. Brasil.* vi. pt. vi. 127.

[2] *Cephalanthus tetrandrus.*

Nauclea tetrandra, Roxburgh, *Fl. Ind.* ii. 125 (1824).

Cephalanthus naucleoides, De Candolle, *Prodr.* iv. 539 (1830). — Kurz, *Forest Fl. Brit. Burm.* ii. 68. — Hance, *Jour. Bot.* xx. 6. — Hooker f. *Fl. Brit. Ind.* iii. 24.

Cephalanthus aralioides, Zollinger, *Syst. Verz.* 61 (1854). — Miquel, *Fl. Ned. Ind.* ii. 152, 344.

Cephalanthus occidentalis, Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 369 (not Linnæus) (1888).

CEPHALANTHUS OCCIDENTALIS.

Button Bush.

Calyx usually 4-lobed; corolla tubular funnel-form, usually glandular. Leaves ovate or lanceolate, acute or acuminate, membranaceous.

Cephalanthus occidentalis, Linnæus, *Spec.* 95 (1753). — Miller, *Dict.* ed. 8. — Du Roi, *Harbk. Baumz.* i. 145. — Wangenheim, *Beschreib. Nordam. Holz.* 140; *Nordam. Holz.* 101. — Lamarck, *Dict.* i. 678; *Ill.* i. 256, t. 59. — Castiglioni, *Viag. negli Stati Uniti*, ii. 222. — Marshall, *Arbust. Am.* 30. — Walter, *Fl. Car.* 84. — Schkuhr, *Handb.* i. 66, t. 21. — Willdenow, *Berl. Baumz.* 58; *Spec.* i. pt. ii. 543; *Enum.* 143. — Borkhausen, *Handb. Forstbot.* ii. 1563. — Gærtner, *Fruct.* ii. 41, t. 86, f. 7. — Michaux, *Fl. Bor.-Am.* i. 87. — Persoon, *Syn.* i. 119. — Du Mont de Courset, *Bot. Cult.* ed. 2, iv. 330. — Desfontaines, *Hist. Arb.* i. 331. — Pursh, *Fl. Am. Sept.* i. 114. — Bigelow, *Fl. Boston.* 33. — Elliott, *Sk.* i. 186. — Nuttall, *Gen.* i. 92. — Mordant de Launay, *Herb. Amat.* iv. 272, t. 272. — Hayne, *Dendr. Fl.* 5. — Barton, *Fl. Am. Sept.* iii. 56, t. 91. — Sprengel, *Syst.* i. 377. — De Candolle, *Prodr.* iv. 538. — Hooker, *Fl. Bor.-Am.* i. 288. — Darlington, *Fl. Cestr.* 98. — Spach, *Hist. Vég.* viii. 463. — Torrey & Gray, *Fl. N. Am.* ii. 31. — Emerson, *Trees Mass.* 349; ed. 2, ii. 394, t. — Torrey, *Fl. N. Y.* i. 313. — Dietrich, *Syn.* i. 452. — Chapman, *Fl.* 176. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 107. — K. Koch, *Dendr.* ii. 76. — Lauche, *Deutsche Dendr.* ed. 2, 185, f. 66. — Gray, *Syn. Fl.* i. pt. ii. 29. — Dippel, *Handb. Laubholzk.* i. 163. — Watson & Coulter, *Gray's Man.* ed. 6, 224. — Britton & Brown, *Ill. Fl.* iii. 216, f. 3403. — Mohr, *Contrib. U. S. Nat. Herb.* vi. 739 (*Plant Life of Alabama*). — Britton, *Man.* 863. — Gattinger, *Fl. Tennessee*, 155.

Cephalanthus oppositifolius, Moench. *Meth.* 487 (1794).

Cephalanthus occidentalis, var. **pubescens**, Rafinesque, *Med. Fl.* 101 (1828).

Cephalanthus occidentalis, var. **macrophyllus**, Rafinesque, *Med. Fl.* 101 (1828).

Cephalanthus occidentalis, var. **obtusifolius**, Rafinesque, *Med. Fl.* 102 (1828).

Cephalanthus occidentalis, var. **brachypodus**, De Candolle, *Prodr.* iii. 539 (1830).

Usually a shrub only a few feet high, or very rarely arborescent at the north,[1] *Cephalanthus occidentalis* in southern Arkansas and eastern Texas, on the margins of river-bottoms and swamps and in their pond holes, often attains a height of from forty to fifty feet with a straight tapering trunk a foot in diameter and frequently free of limbs for twenty feet, and ascending and spreading branches. The bark of large trunks is dark gray-brown or often nearly black and divided by deep fissures into broad flat ridges broken on the surface into elongated narrow scales. The branchlets are stout, with a thick pith, and are glabrous, marked by large oblong pale lenticels, and developed mostly in verticils of threes from the axillary buds of one of the upper nodes, the end of the branch dying back, at the north at least, in the autumn;[2] they are light green when they first appear, pale reddish brown covered with a glaucous bloom during their first winter, when they are marked by the small semicircular leaf-scars, which show semilunate fibrovascular bundle-scars, and are connected by the stipule-scars or by the persistent black stipules; during the following season the branchlets become darker and dark brown in their third year, when the fissures usually appear and the bark begins to separate into the large loose scales which are found on the large branches and on the stems of small plants. The axillary buds are single or in pairs or in threes one above the other, minute and nearly immersed in the bark. The leaves are ovate or lanceolate, acute, acuminate or short-pointed at the apex, rounded or cuneate at the base, membranaceous, dark green on the upper surface, paler and glabrous or puberulous on the lower surface, from four to seven inches long and from an inch to three inches and a half wide, with stout light yellow midribs, five or six pairs of slender

[1] Britton, *Jour. N. Y. Bot. Gard.* i. 54, f. 11.

[2] Foerste, *Bull. Torrey Bot. Club*, xx. 162; *Bot. Gazette*, xx. 79, t. 8, f. 1, c–g.

primary veins nearly parallel with the sides of the leaf, and stout grooved glabrous or puberulous petioles from one half to three quarters of an inch in length. The stipules are minute, nearly triangular, deciduous, or persistent during the winter. The flower-heads are panicled and from an inch to an inch and a half in diameter. The creamy white flowers, which open from the middle of May in Florida and Texas to the middle of August in the Atlantic states and Canada, and on the mountains of California, are very fragrant. The calyx is usually four but occasionally five-lobed, with short rounded lobes, and is slightly villose toward the base. The corolla is tubular funnel-form, puberulous on the inner face, and glandular or eglandular. The anthers are nearly sessile, included, and discharge their pollen before the flowers open.[1] The disk is thin and obscure, and the style is elongated, with an entire stigma. The heads of fruit, which ripen late in the autumn, are from five eighths to three quarters of an inch in diameter, green tinged with red, and ultimately dark red-brown.

Cephalanthus occidentalis grows in swamps and the low wet borders of ponds and streams, and ranges from New Brunswick to Ontario[2] and eastern Nebraska[3] and Kansas,[4] and southward to Florida, Texas, New Mexico, and Arizona. It is also widely distributed in California,[5] and grows in Mexico[6] and Cuba.[7]

The bark of *Cephalanthus occidentalis* contains tannin, and, although its medical virtues are problematical, it has been often used in the treatment of fevers[8] and in homœopathic practice.[9]

The earliest account of *Cephalanthus occidentalis* was published by Plukenet in 1691.[10] According to Aiton it was cultivated in England by Philip Miller in 1735.[11]

[1] Cross fertilization of the flowers of *Cephalanthus occidentalis* is secured by the early maturity of the anthers. These discharge their pollen before the buds open in a conical mass on the immature stigma, which later is carried by the lengthening of the style to a point high above the flowers where it must come in contact with insects which are attracted in great numbers to the flower-heads by their fragrance and by the abundant nectar in the bottom of the corollas, and which carry the pollen masses from the immature stigma of one flower to the mature stigma of another. (See Robertson, *Bot. Gazette*, xvi. 65. — Blanchan, *Nature's Garden*, 251, t.)

Meehan believed that the early discharge of the pollen on to the stigma resulted in self-fertilization, but his own observations do not appear to support his theory, as he found that only one in five flowers of a head were fertilized, a fact which Robertson takes as presumptive evidence against self-fertilization. (See Meehan, *Proc. Phil. Acad.* 1887, 327 [*Contributions to the Life History of Plants*].)

[2] Provancher, *Flore Canadienne*, i. 291. — Brunet, *Cat. Vég. Lig. Can.* 34. — Macoun, *Cat. Can. Pl.* 199.

[3] Bessey, *Bull. Exper. Stat. Nebraska*, iv. art. iv. 22.

[4] Hitchcock, *Fl. Kansas*, plate xvi.

[5] Gray, *Brewer & Watson Bot. Cal.* i. 282. — Eastwood, *Bull. Sierra Club*, iv. 58.

[6] Hemsley, *Bot. Biol. Am. Cent.* ii. 6.

In southern Arizona and in Mexico the leaves of *Cephalanthus occidentalis* are often much narrower than those usually produced by northern plants, although the leaves vary greatly everywhere on different individuals. The narrow-leaved Mexican form is

Cephalanthus occidentalis, var. *salicifolius*, Gray, *Syn. Fl. N. Am.* i. pt. ii. 29 (1884).

Cephalanthus salicifolius, Humboldt & Bonpland, *Pl. Æquin.* ii. 63, t. 98 (1809). — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 381. — Kunth, *Syn. Pl. Æquin.* iii. 39. — De Candolle, *Prodr.* iii. 539. — Dietrich, *Syn.* i. 452. — Hemsley, *l. c.*

[7] Grisebach, *Cat. Pl. Cuba*, 139.

[8] Rafinesque, *Med. Fl.* 100, t. 20. — Griffith. *Med. Bot.* 356. — Johnson, *Man. Med. Bot. N. Am.* 168. — *U. S. Dispens.* ed. 16, 1750. — Parke, Davis & Co., *Organic Mat. Med.* 37.

[9] Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, i. 76, t. 76.

[10] *Arbor Americana triphylla, fructu Platani quodammodo æmulante*, Plukenet, *Phyt.* t. 77, f. 4; *Almagest. Bot.* 47.

Scabiosa dendroides Americana, ternis foliis circa caulem ambientibus, floribus ochroleucis, Plunkenet, *Almagest. Bot.* 336.

Platanocephalus tini foliis ex adverso ternis, Vaillant, *Mém. Acad. Sci. Paris*, 1722, 191.

Cephalanthus foliis ternis, Linnæus, *Hort. Cliff.* 73. — Royen, *Fl. Leyd. Prodr.* 187.

Cephalanthus foliis oppositis & ternis, Clayton, *Fl. Virgin.* 15.

Cephalanthus, Duhamel, *Traité des Arbres*, i. 145.

[11] *Hort. Kew.* i. 132. — Loudon, *Arb. Brit.* ii. 1061, f. 828, 829.

EXPLANATION OF THE PLATE.

Plate DCCXI. Cephalanthus occidentalis.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower with bractlet, enlarged.
4. Vertical section of a flower, the corolla removed, enlarged.
5. A corolla laid open, enlarged.
6. A stamen, front and rear views, enlarged.
7. A head of fruit, natural size.
8. A fruit divided transversely, enlarged.
9. Vertical section of a fruit, enlarged.
10. A seed, rear view, enlarged.
11. Vertical section of a seed cut at right angles with the back, enlarged.
12. Vertical section of a seed cut parallel with the back, enlarged.
13. An embryo, enlarged.

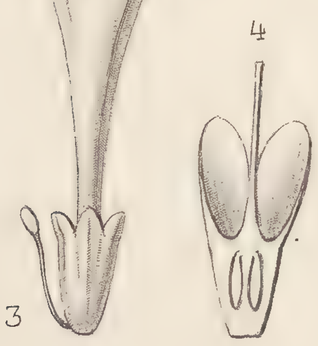
7

1

2

13

3



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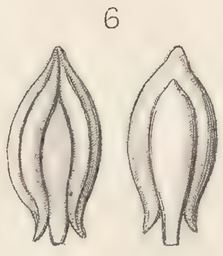

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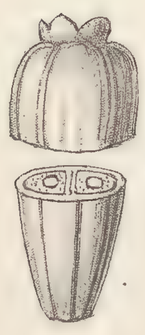


9

10

11

12

C.E.Faxon del.

Rapine sc.

CEPHALANTHUS OCCIDENTALIS, L.

A.Riocreux direx.t

Imp. J.Taneur, Paris

ELLIOTTIA.

FLOWERS perfect; calyx 4 or 5-lobed or divided, the lobes imbricated in æstivation; petals 3 to 5, slightly imbricated or subvalvate in æstivation; stamens 3 to 10; ovary superior, 3 to 5-celled; ovules numerous. Fruit capsular, sessile, or stipitate. Leaves alternate, membranaceous, destitute of stipules.

Elliottia, Elliott, *Sk.* i. 448 (1817). — Nuttall, *Gen.* ii. Additions. — Endlicher, *Gen.* 756. — Meisner, *Gen.* 247. — Bentham & Hooker, *Gen.* ii. 598. — Baillon, *Hist. Pl.* xi. 175. — Drude, *Engler & Prantl Pflanzenfam.* iv. pt. i. 32.

Tripetaleia, Siebold & Zuccarini, *Abhand. Akad. Münch.* iii. 731, t. 3, f. 2 (1843). — Drude, *Engler & Prantl Pflanzenfam.* iv. pt. i. 33.

Glabrous trees or shrubs, with terete or angled branchlets, scaly buds, and fibrous roots. Leaves alternate, obovate or elliptical, entire, glandular-apiculate, membranaceous, petiolate, destitute of stipules, deciduous. Flowers white or rose-colored, pedicellate, in erect terminal elongated racemose panicles; bracts and bractlets minute, caducous, or foliaceous and persistent. Calyx four or five-lobed or divided. Petals three to five, linear-oblong, sessile, equal or very unequal, revolute after anthesis. Stamens four to ten, hypogynous; filaments flattened; anthers oblong, attached on the back near the base, two-celled, the cells free at the apex, opening longitudinally from above downward. Disk thin or much thickened. Ovary sessile or stipitate, subglobose, three to five-lobed, concave at the apex; style elongated, slender or thickened, curved or declinate, gradually enlarged and club-shaped above; stigma three to five-lobed, smaller than the thickened end of the style; ovules numerous in each cell, attached on the inner angle of a tumid placenta, ascending, anatropous. Fruit capsular, subglobose, depressed at the apex, sessile or stipitate, three to five-lobed, opening septicidally from above downward into three to five valves free from the placentiferous axis. Seeds compressed, ovoid, or ellipsoidal; testa cellulose; embryo minute, clavate, two-lobed, in fleshy albumen.[1]

Three species of Elliottia are now known. One, the type of the genus, inhabits the states of Georgia and South Carolina, and the others are small shrubs of central and northern Japan.[2]

The genus commemorates in its name Stephen Elliott,[3] the distinguished author of the *Sketch of the Botany of South Carolina and Georgia.*

[1] The three species of Elliottia were arranged by Bentham & Hooker in three sections: —

1. Calyx four-toothed, short, cup-shaped. Petals four. Stamens twice as many as the petals. Ovary sessile. Bracts and bractlets minute, caducous. (*Elliottia racemosa.*)

2. Calyx five-lobed, short, cup-shaped. Petals three to five. Stamens three to six. Ovary stipitate. Bracts linear. (*Elliottia paniculata.*)

3. Calyx five-parted, the divisions linear-oblong, longer than the fruit. Petals three to five. Stamens as many as the petals. Ovary sessile. Bracts foliaceous, persistent. (*Elliottia bracteata.*)

[2] Maximowicz, *Bull. Acad. Sci. St. Pétersbourg,* xi. 433 (*Mél. Biol.* vi. 206); xvi. 401; xviii. 52 (*Mél. Biol.* viii. 621) (Tripetaleia). — Franchet & Savatier, *Enum. Pl. Jap.* i. 294.

[3] See xi. 159.

ELLIOTTIA RACEMOSA.

Calyx short, cupular, 4-toothed; petals 4; stamens 8; ovary sessile on a thickened disk.

Elliottia racemosa, Elliott, *Sk.* i. 448 (1817). — Chapman, *Fl.* 273. — Baillon, *Adansonia*, i. 205. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 44. — Sargent, *Garden and Forest*, vii. 207, f. 37.

A tree, fifteen or twenty feet in height, with a trunk four or five inches in diameter covered with thin smooth light gray bark, and short ascending branches which form a narrow pyramidal head; or more frequently shrubby. The branchlets are erect, slender, and terete, and when they first appear light red-brown and pilose; during their first winter they are bright orange-brown, lustrous and nearly glabrous, light brown slightly tinged with red during their second season, and dark gray-brown the following year. The terminal winter-buds are broadly ovate, acute, and about an eighth of an inch long, with much thickened bright chestnut-brown shining scales conspicuously white-pubescent near the margins toward the apex. The leaves are oblong or oblong-ovate, acute at the ends or occasionally rounded at the apex, membranaceous, dark green and glabrous on the upper surface, pale and villose on the lower surface particularly along the thin yellow midribs and obscure forked veins, from three to four inches long and from an inch to an inch and a half wide; they are borne on slender flattened villose petioles from one third to one half of an inch in length, and abruptly enlarged at the base, which nearly covers the small ovate compressed axillary buds; these are rounded or short-pointed at the apex. The leaf-scars are slightly raised and oblong-obovate, with conspicuous central fibrovascular bundle-scars. The flowers, which are about half an inch long, open from the middle to the end of June, and are borne on slender elongated pedicels, in loose many-flowered racemose panicles from seven to ten inches in length, with acute scarious caducous bracts and bractlets. The calyx is short, cup-shaped, dark red-brown, and puberulous, with broad apiculate teeth erose on the margins. The four petals are spatulate-linear and white. The eight stamens are shorter than the petals, with elongated broad flattened filaments and oblong-ovate anthers callous-mucronate at the tips of the spreading lobes. The ovary is sessile on a thick fleshy disk, four-celled, and abruptly narrowed into the slender elongated style, incurved at the apex, and the ovules are numerous in each cell. The fruit is still unknown.

Elliottia racemosa, which is one of the rarest North American trees, inhabits sandy woods in a few isolated stations in the valley of the Savannah River near Augusta, and in Burke and Bullock counties, Georgia. It was discovered early in the nineteenth century near Waynesboro, Georgia, and was included, but without a description, by Muehlenberg in his *Catalogus Plantarum Americæ Septentrionalis* published in 1813.[1]

Three or four plants taken from the woods near Augusta in 1875 by Asa Gray and planted in Mr. Berckmans's nursery in that city have grown into shapely trees and are still flourishing. There is only one other record[2] of the successful cultivation of this plant.

[1] *Elliottia racemosa* was discovered near Waynesboro, Burke County, Georgia, perhaps by Stephen Elliott himself. Much later it was found near Augusta, and in 1853 Mr. S. T. Olney collected it at Hamburg on the South Carolina side of the Savannah River opposite Augusta. No trace of Elliottia has been found in these stations by the botanists who have visited them in recent years but in June, 1901, Mr. R. M. Harper found a colony of the plants near Bloys, Bullock County, Georgia, about forty miles south of Waynesboro. (See Small, *Jour. N. Y. Bot. Gard.* ii. 113. — Harper, *Plant World*, v. 87, f. 12.) Elliott states that he had also received specimens of Elliottia from the Oconee [River]. (*Sk.* i. 448.)

[2] Muehlenberg states that a Mr. Oemler "had the shrub, once, in his garden." (See letter of April 20, 1813, to Baldwin in *Reliquiæ Baldwinianæ*, 79.)

EXPLANATION OF THE PLATE.

PLATE DCCXII. ELLIOTTIA RACEMOSA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A petal, enlarged.
4. A stamen, front and rear views, enlarged.
5. Portion of a style and stigma, enlarged.
6. An ovary, enlarged.
7. Vertical section of an ovary, enlarged.
8. Cross section of an ovary, enlarged.

C.E. Faxon del.

Lartaud sc.

ELLIOTTIA RACEMOSA, Ell.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

FRAXINUS CORIACEA.

Ash.

LEAFLETS 5, ovate to oblong, mostly coarsely serrate, long-petiolulate.

Fraxinus coriacea, Watson, *Am. Nat.* vii. 302 (1873); *Cat. Pl. Wheeler*, 15. — Rothrock, *Wheeler's Rep.* vi. 185, t. 22. — Coville, *Contrib. U. S. Nat. Herb.* iv. 148 (*Bot. Death Valley Exped.*).

Fraxinus pistaciæfolia, var. **coriacea**, Gray, *Syn. Fl. N. Am.* ii. pt. i. 74 (1878). — Wenzig, *Bot. Jahrb.* iv. 182.

Fraxinus pistaciæfolia, Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 106 (in part) (not Torrey) (1884).

Fraxinus velutina, Sargent, *Silva N. Am.* vi. 41 (in part) (not Torrey) (1894).

A tree, occasionally thirty feet in height, with a trunk from twelve to sixteen inches in diameter, stout spreading branches forming a round-topped head, and comparatively slender ashy gray branchlets which, tomentose when they first appear and coated with soft fine pubescence for one or two years, are ultimately glabrous. The leaves are generally about six inches long, with stout grooved pubescent petioles, and usually five leaflets; these are ovate or oblong, acute, acuminate or rounded at the apex, broadly cuneate or rounded at the base, coarsely repand-serrate, long-petiolulate, coated as they appear with long pale hairs, which are most abundant on the lower surface, and at maturity thick and firm in texture, dark green and glabrous on the upper surface, pale and glabrous or pubescent on the lower surface, from two to three inches long and from one to two inches wide. On leading shoots the leaves are sometimes reduced to single long-stalked leaflets, or are three-foliolate, with a large terminal leaflet and small lateral leaflets. The flowers, which appear about the middle of April with or before the unfolding leaves, are produced in short compact panicles, the males and females on different individuals from buds in the axils of leaves of the previous year, covered by broadly ovate scales rounded and often short-pointed at the apex, and coated on the outer surface with rusty tomentum. The calyx is cup-shaped and larger and more deeply divided in the pistillate than in the staminate flower. The anthers are oblong and nearly sessile. The ovary is abruptly narrowed into the slender style slightly divided into two stigmatic lobes. The fruit ripens late in the season, and is borne in narrow clusters from two to three inches in length; it is slender, oblong, from three quarters of an inch to an inch long, and the wing, which is rounded and often emarginate at the apex and about an eighth of an inch wide, is about as long as the terete wingless body.[1]

Fraxinus coriacea inhabits the desert region of southern Utah, northern Arizona, southern Nevada, and southeastern California, and has been collected in the neighborhood of St. George, Utah,[2] at Ash Meadows, Nevada,[3] in the Devil Run Cañon, Arizona,[4] and on Cottonwood Creek on the west side of Owen's Lake, California.[5]

[1] In the sixth volume of this work *Fraxinus coriacea* was considered a form of *Fraxinus velutina*. It differs from that species in its fewer longer-stalked leaflets which are more coriaceous and more coarsely serrate, and in its range, *Fraxinus coriacea* being a tree of the mesas and low plains, while *Fraxinus velutina* is an inhabitant of mountain cañons; and with our still slight knowledge of the southwestern species of Fraxinus it is perhaps best to consider it a species.

[2] By Dr. Edward Palmer in 1875, and by J. W. Carpenter in 1898.

[3] By Lieutenant Wheeler, U. S. A., in 1871, and by Dr. Frederick V. Coville on the Death Valley Expedition in 1891.

[4] By Dr. J. M. Bigelow of the Mexican Boundary Survey (*teste* S. Watson), who was probably the discoverer of this tree.

[5] By Dr. Frederick V. Coville on the Death Valley Expedition in 1891.

EXPLANATION OF THE PLATE.

PLATE DCCXIII. FRAXINUS CORIACEA.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A branch with pistillate flowers, natural size.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. Vertical section of a fruit, natural size.
7. A winter branchlet, natural size.

C.E.Faxon del.

Rapine sc.

FRAXINUS CORIACEA, S.Wats.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

FRAXINUS PROFUNDA.

Pumpkin Ash.

LEAFLETS 7 to 9, lanceolate to ovate-lanceolate, pubescent on the lower surface, petiolulate.

Fraxinus profunda, Bush, *Garden and Forest*, x. 515 (1897). — Britton, *Man.* 725.

Fraxinus Americana, var. **profunda**, Bush, *Rep. Missouri Bot. Gard.* v. 147 (1894).

A tree, sometimes one hundred and twenty feet in height, with a slender trunk occasionally three feet in diameter above the much enlarged and buttressed base, and small spreading branches which form a narrow and rather open head; or often much smaller.[1] The bark of the trunk varies from one half to three quarters of an inch in thickness, and is light gray and divided by shallow fissures into broad flat or rounded ridges broken on the surface into thin closely appressed scales. The branchlets are stout, marked by large pale lenticels, and coated when they first appear with hoary tomentum; they are tomentose or pubescent during their first winter, and light gray and pilose or glabrous the following year. The large oblong slightly raised leaf-scars are rounded at the base and obconic at the apex, which nearly incloses the small ovate obtuse lateral buds. The terminal buds are broadly ovate, obtuse, light reddish brown, and covered with close pale pubescence. The leaves vary from nine to eighteen inches in length, with stout tomentose petioles and usually seven but occasionally nine long-stalked leaflets; these are lanceolate or ovate-lanceolate, acuminate or abruptly long-pointed at the apex, and rounded or broadly cuneate, and usually unsymmetrical at the base; when they unfold they are coated on the lower surface, like their stalks, with hoary tomentum, and are pilose on the upper surface, with short pale hairs, particularly along the midribs and veins, and at maturity they are thick and firm in texture, dark yellow-green and nearly glabrous above, soft-pubescent below, from five to ten inches long and from two to five inches wide, with stout yellow midribs deeply impressed and puberulous above, and numerous slender primary veins arcuate and connected near the margins, which are undulate and entire or slightly serrate, with small remote teeth. The staminate and pistillate flowers are produced on different trees in elongated much-branched pubescent panicles, with oblong or oblong-obovate scarious bracts and bractlets. The staminate flower is composed of a minute campanulate obscurely four-toothed calyx and two or three stamens, with oblong apiculate anthers and comparatively long slender filaments. The calyx of the pistillate flower is large, deeply lobed, accrescent and persistent under the fruit, and the ovary is gradually contracted into the slender style which is divided into two dark spreading stigmatic lobes. The fruit, which is produced in long drooping many-fruited clusters, varies from two and a half to three inches in length; it is oblong, with a wing which is often half an inch wide and sometimes falcate, rounded, apiculate or emarginate at the apex, and decurrent to below the middle or nearly to the base of the thick terete many-rayed body.

Fraxinus profunda grows in deep river-swamps often inundated during several months of the year in Dunkin and New Madrid counties, southeastern Missouri, in Clay and Lincoln counties in eastern Arkansas, and on the lower Appalachicola River in western Florida.[2]

[1] The tree cut by Mr. Bush near Varner, Lincoln County, Arkansas, to obtain a specimen for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, was one hundred and eighteen feet in height, with a trunk thirty-three inches in diameter at three feet above the surface of the ground. It was two hundred years old, with eighty-one layers of sapwood, which was four inches in thickness.

[2] *Fraxinus profunda* appears to have been first collected on the Appalachicola River on June 7, 1897, by F. Roth. It was found in the same locality by B. F. Bush in August of the same year, and in March, 1898, by Dr. A. W. Chapman and C. S. Sargent.

This magnificent tree, which surpasses the other American species of this genus in the size of its leaves and fruit and in the size of the calyx of the pistillate flower, was discovered in September, 1893, by Mr. B. F. Bush at Campbell, Missouri.[1]

[1] The Ash-tree from the Atlantic coast, referred to this species by Ashe (*Bot. Gazette*, xxviii. 271), judging by the small fruiting calyx and the glabrous leaves of the fragmentary specimens which Mr. Ashe has sent to me from the bottoms of the Cape Fear River, North Carolina, is probably *Fraxinus Americana*.

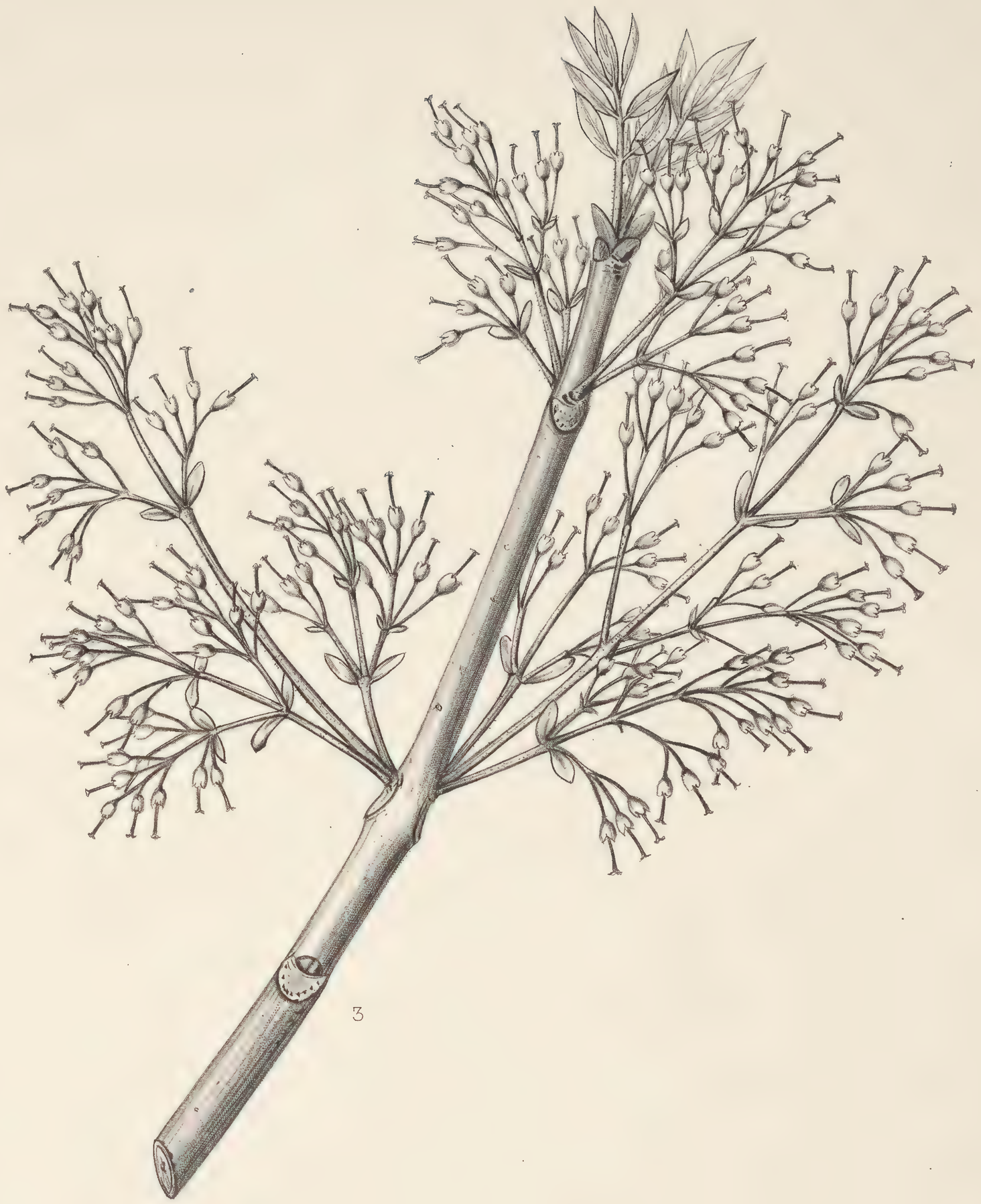
EXPLANATION OF THE PLATES.

PLATE DCCXIV. FRAXINUS PROFUNDA.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A branch with pistillate flowers, natural size.
4. A pistillate flower, enlarged.

PLATE DCCXV. FRAXINUS PROFUNDA.

1. A cluster of fruit, natural size.
2. A leaf, natural size.
3. A winter branchlet, natural size.



C.E. Faxon del. *Em. Himely sc.*

FRAXINUS PROFUNDA, Bush.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

C.E. Faxon del. Em. Himely sc.

FRAXINUS PROFUNDA, Bush.

A. Riocreux direx.t Imp. J. Taneur, Paris.

FRAXINUS BILTMOREANA.

Ash.

LEAFLETS 7 to 9, ovate-oblong or lanceolate, acuminate, pale and pubescent below, long-petiolulate.

Fraxinus Biltmoreana, Beadle, *Bot. Gazette*, xxv. 358 (1898). — Mohr, *Contrib. U. S. Nat. Herb.* vi. 666 (*Plant Life of Alabama*). — Britton, *Man.* 725.

A tree, forty or fifty feet in height, with a trunk seldom more than a foot in diameter covered with dark gray slightly furrowed rough bark, and stout ascending or spreading branches which form an open symmetrical head. The branchlets are stout, light or dark gray, soft-pubescent usually during two seasons and much roughened during the winter, and often for two or three years, by the large elevated mostly obcordate or sometimes orbicular leaf-scars which display a marginal line of fibrovascular bundle-scars.[1] The terminal winter-buds are ovate and usually broader than they are long and covered with bright brown scales, the two outer scales being keeled on the back and apiculate at the apex, and the others rounded, accrescent, and slightly villose. The leaves are from ten to twelve inches long, with stout pubescent or puberulous petioles and seven or nine leaflets raised on stout elongated pubescent petiolules; the leaflets are ovate-oblong or lanceolate, often falcate, acuminate at the apex, rounded or broadly cuneate and often inequilateral at the base; when they unfold they are yellow-bronze color, nearly glabrous above, coated below particularly on the midribs and veins with long white hairs, and at maturity they are from three to four inches long and from two thirds of an inch to an inch wide, thick and firm in texture, dark green and slightly lustrous on the upper surface, pale or glaucous and puberulous on the lower surface along the slender yellow midribs and primary veins which are arcuate near the slightly thickened and incurved entire or remotely and obscurely toothed margins. The flowers appear with the leaves about the first of May, the males and females on different trees in rather compact glabrous or pubescent panicles, with scarious caducous bracts and bractlets, from the axils of leaves of the previous year. The staminate flower is composed of a minute cup-shaped very obscurely dentate calyx and nearly sessile oblong acute anthers. The calyx of the pistillate flower is much larger and deeply lobed, and the oblong ovary is gradually narrowed into the slender style which is divided at the apex into two short stigmatic lobes. The fruit, which is produced in elongated glabrous or puberulous clusters, is from an inch and a half to an inch and three quarters long, with a wing which is only slightly narrowed at the ends, emarginate at the apex, about a quarter of an inch wide, and from two and a half to three times longer than the short elliptical marginless many-nerved body.

Fraxinus Biltmoreana inhabits the banks of streams and rarely low river benches, and is distributed from northern West Virginia[2] through the foothill region of the Appalachian Mountains to northern Georgia[3] and Alabama,[4] and to middle Tennessee.[5] It was first distinguished in 1893 by Mr. C. D. Beadle[6] in the neighborhood of Biltmore, North Carolina, where it is the common Ash-tree.

[1] Until the plants are about four years old their stems and branches are quite glabrous. The branches, which are developed later, are covered with the pubescence which is one of the best characters by which this tree can be distinguished from *Fraxinus Americana*.

[2] In 1897 *Fraxinus Biltmoreana* was found by Professor A. D. Hopkins near Easton, Monongalia County, West Virginia.

[3] In Georgia *Fraxinus Biltmoreana* has been collected by J. K. Small near Tacoa, Habersham County, in August, 1895, and by C. L. Boynton on Little Stone Mountain, De Kalb County.

[4] In Alabama *Fraxinus Biltmoreana* has been collected by T. G. Harbison in Marshall, Jackson, and De Kalb counties; and near Gadsden, where this tree is common, by C. D. Beadle.

[5] In the Herbarium of the Arnold Arboretum there is an undated specimen of *Fraxinus Biltmoreana* collected by Dr. A. Gattinger at Nashville.

[6] See xiii. 66.

EXPLANATION OF THE PLATE.

PLATE DCCXVI. FRAXINUS BILTMOREANA.

1. A flowering branch of a staminate tree, natural size.
2. A staminate flower, enlarged.
3. A flowering branch of a pistillate tree, natural size.
4. A pistillate flower, enlarged.
5. A cluster of fruits, natural size.
6. Vertical section of a fruit, natural size.
7. A seed, natural size.
8. A leaf, natural size.
9. A winter branchlet, natural size.

C.E. Faxon del. Rapine sc.

FRAXINUS BILTMOREANA, Bead.

A. Riocreux direx.t Imp. J. Taneur, Paris.

FRAXINUS FLORIDANA.

Water Ash.

LEAFLETS usually 3 to 5, oblong, acuminate, long-petiolulate.

Fraxinus Floridana.

Fraxinus platycarpa, var. **Floridana**, Wenzig, *Bot. Jahrb.* iv. 185 (1883).

Fraxinus Caroliniana, Sargent, *Silva N. Am.* vi. 55 (in part) (not Miller) (1894).

A small Ash-tree which grows in ponds and deep river-swamps in eastern and western Florida and in southern Georgia and which has usually been considered a form of the Water Ash, *Fraxinus Caroliniana* varies constantly from that species in the form of the fruit. It is desirable that a plate of this second species of Water Ash should appear in a Silva of North America, and although the foliage and winter-buds do not afford characters by which the two trees can be readily distinguished in the herbarium, it is convenient to treat them as species rather than as varieties. The fruit of *Fraxinus Caroliniana* is elliptical or spatulate and frequently three-winged, with thin wings which surround the short slender compressed body, and are acute at the apex, not much more than twice as long as they are wide, usually narrowed below into a short stalk-like base, many-nerved, and marked by conspicuous deeply impressed midnerves. The fruit of *Fraxinus Floridana*, as the second species must be called, is lanceolate or oblanceolate, rounded and emarginate at the gradually narrowed apex, and about four times as long as it is wide, with rather obscure midveins.

Fraxinus Floridana was described by Wenzig from specimens collected in Florida by Cabanis[1] more than sixty years ago. It has been collected in recent years near Jacksonville,[2] Eustis,[3] and Appalachicola,[4] Florida, and in Charlton County, southern Georgia.[5]

[1] Jean Cabanis (March 8, 1816) was born in Berlin of a family of French Protestants which had emigrated to Germany during the reign of Louis XIV. He began his scientific career as assistant in the Zoölogical Museum at Berlin during the administration of Professor Lichtenstein and under his direction visited the United States to collect birds. He remained in America from 1839 to 1843 and made large ornithological collections in South Carolina, where he spent most of his time during his American visit, and in Florida. His small collection of American plants is preserved in the Botanical Museum at Berlin. Cabanis has been a prolific writer on systematic ornithology. He contributed the account of the birds in the third volume of Schomburgk's work on Guiana, published in 1848, and the *Ornithologische Notizen* in Wiegmann's *Archiv für Naturgeschichte*, published in 1847, and with F. Heine was the author of *Verzeichniss der ornithologischen Sammlung des Museum Heineanum*, 1850–63. His most important work appeared in the *Journal für Ornithologie*, of which he was the editor from 1853 to 1893.

[2] By A. H. Curtiss, No. 2321.

[3] By G. V. Nash, August, 1894, and distributed as *Fraxinus epiptera*.

[4] By J. Roth, May, 1897, and by Chapman and Sargent, March, 1898.

[5] By J. K. Small, January, 1895, in the St. Mary's River Swamp below Traders' Hill, and distributed as *Fraxinus epiptera*.

A specimen collected by Fendler at New Orleans in April, 1846 (in herb. Engelmann), with partly grown fruit is perhaps of this species, as are possibly specimens distributed by Ashe as *Fraxinus epiptera* from Bladen County, North Carolina (Nos. 1860 and 1862).

EXPLANATION OF THE PLATE.

PLATE DCCXVII. FRAXINUS FLORIDANA.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A branch with pistillate flowers, natural size.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. A fruit, natural size.
9. A leaf, natural size.

C.E. Faxon del.

Rapine sc.

FRAXINUS FLORIDANA, Sarg.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

ULMUS SEROTINA.

Red Elm.

FLOWERS autumnal, long-pedicellate. Fruit ciliate on the margins. Leaves oblong to oblong-obovate, acuminate. Bud-scales glabrous. Branchlets often furnished with corky wings.

Ulmus serotina, Sargent, *Bot. Gazette*, xxvii. 92 (1899). — Mohr, *Contrib. U. S. Nat. Herb.* vi. 474 (*Plant Life of Alabama*). — Gattinger, *Fl. Tennessee*, 69.

Ulmus racemosa, Chapman, *Fl.* ed. 2, Suppl. 649 (not Borkhausen nor Thomas) (1883); ed. 3, 444. — Sargent, *Silva N. Am.* vii. 47 (in part).

A tree, with a trunk forty or fifty feet in height, and from two to three feet in diameter, and comparatively small spreading or pendulous branches which often form a broad and handsome head. The bark of the trunk is from one quarter to three eighths of an inch in thickness, light brown slightly tinged with red, and divided by shallow fissures into broad flat ridges broken on the surface into large thin closely appressed scales. The branchlets are slender and pendulous, and when they first appear are glabrous or occasionally puberulous; during their first year they are light reddish brown, lustrous and marked by occasional oblong white lenticels, darker the following season, ultimately dark gray-brown, and often furnished with two or three thick corky wings which are developed during their second or third years. The winter-buds are ovate, acute, and a quarter of an inch long; their outer scales are oblong-obovate, dark chestnut-brown, and glabrous, and the inner scales are accrescent, often scarious on the margins, rounded or acute at the apex, pale yellow-green, lustrous, and sometimes three quarters of an inch long when fully grown. The leaves are oblong or oblong-obovate, acuminate at the apex, very oblique at the base, and coarsely and doubly crenulate-serrate; when they unfold they are coated below with shining white hairs and puberulous above, and at maturity they are thin but firm in texture, yellow-green, glabrous and lustrous on the upper surface, pale and puberulous along the midribs and principal veins on the lower surface, from two to four inches long and from an inch to an inch and three quarters wide, with prominent yellow midribs and about twenty pairs of primary veins extending obliquely to the points of the principal teeth and often forked near the margin of the leaf, and numerous reticulate veinlets; they are borne on stout petioles about a quarter of an inch long, and in the autumn turn clear orange-yellow before falling. The stipules are abruptly narrowed from broad clasping bases, linear-lanceolate, usually about a quarter of an inch long, and persistent until the leaves are nearly fully grown. The inflorescence buds appear early in the season in the axils of leaves of the year, and the flowers open in September; they are borne on slender conspicuously jointed pedicels often an eighth of an inch long, in many-flowered glabrous racemes from an inch to an inch and a half in length. The calyx is six-parted to the base, with oblong-obovate reddish brown divisions rounded at the apex. The ovary is sessile, narrowed below, and villose. The fruit ripens early in November, and is stipitate, oblong-elliptical, deeply divided at the apex, fringed on the margins with long silvery white hairs, and about half an inch long.

Ulmus serotina inhabits limestone hills and river banks from central Tennessee to northern Alabama and northeastern Georgia.[1]

[1] *Ulmus serotina* was collected by Rugel (see ix. 110) on the French Broad River near the boundary between North Carolina and Tennessee in October, 1842; it was found near Nashville by Dr. A. Gattinger as early at least as 1879, and, although he noticed its autumnal flowers, it was referred by him to *Ulmus racemosa*. It was distributed without flowers or fruit as *Ulmus racemosa* from the Biltmore herbarium (No. 3634b) from collections made at Nashville in 1897. On the 9th of October, 1898, a single large tree

The wood of *Ulmus serotina* is hard, close-grained, very strong and tough, and susceptible of receiving a beautiful polish: it contains numerous obscure medullary rays and bands of one or two layers of small open ducts marking the layers of annual growth, and is light red-brown, with pale yellow sapwood.[1]

Ulmus serotina has been occasionally planted as a shade tree in the streets of Huntsville, Alabama, and Rome, Georgia, where it is distinguished by its broad handsome head of pendulous branches. In 1899 young plants raised from seeds gathered at Huntsville the previous autumn were distributed from the Biltmore nurseries. The hardiness of this handsome and distinct tree has not yet been sufficiently tested in the northern states.

covered with fruit was seen by John Muir, W. M. Canby, and C. S. Sargent close to the highroad which leads eastward from Huntsville, Alabama, across the ridge known as Monte Sano. Subsequently it was found to be abundant on the hills near Huntsville and on those in the neighborhood of Rome, Georgia, by Mr. C. L. Boynton of the Biltmore herbarium. It is the *Ulmus racemosa* of Chapman's *Flora* so far as relates to the river banks of Tennessee, and the *Ulmus racemosa* for middle Tennessee of Sargent's *Silva*.

[1] The specimen of *Ulmus serotina* in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is seventeen and a quarter inches in diameter inside the bark and one hundred and twenty-eight years old, with twelve layers of sapwood, which is three quarters of an inch in thickness.

EXPLANATION OF THE PLATE.

PLATE DCCXVIII. ULMUS SEROTINA.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. A pistil, enlarged.
4. A fruiting branch, natural size.
5. Vertical section of a fruit, enlarged.
6. A seed, enlarged.
7. An embryo, enlarged.
8. A winter branchlet, natural size.
9. Portion of a branchlet with corky wings, natural size.

C.E. Faxon del.

Rapine sc.

ULMUS SEROTINA, Sarg.

A. Riocreux dirext.

Imp. J. Taneur, Paris.

HICORIA TEXANA.

Bitter Pecan.

LEAFLETS 7 to 11, lanceolate, often falcate. Fruit 4-winged to the base; nut oblong, compressed, thin-shelled; seed deeply penetrated by the folds of the inner wall of the shell.

Hicoria Texana, Le Conte, *Proc. Phil. Acad.* 1853, 402, f. — Britton, *Bull. Torrey Bot. Club*, xv. 282.

Carya Texana, C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 33 (1862); *Prodr.* xvi. pt. ii. 145.

A tree, on rich river-bottoms sometimes a hundred feet in height, with a tall straight trunk three feet in diameter and ascending branches, and on the borders of prairies in low wet woods usually from fifteen to twenty-five feet tall, with a short trunk eight or ten inches in diameter, and small spreading branches which form a narrow round-topped head. The bark of the trunk is from one half to three quarters of an inch in thickness, light reddish brown, and roughened by closely appressed variously shaped plate-like scales. The branchlets are slender, and when they first appear are coated with thick hoary tomentum which is sometimes persistent until the autumn, and during their first winter they are bright red-brown and marked by occasional large pale lenticels, darker in their second season, and dark or light gray-brown in their third year. The scales of the winter-buds are valvate and covered with light yellow articulate hairs. The terminal buds are oblong, acute or acuminate, somewhat compressed, about a quarter of an inch long, and rather longer than the upper lateral buds; these are usually stalked and two or three times as large as the lower lateral buds, which are nearly surrounded by the thin membranaceous border of the large concave obcordate leaf-scars. The leaves are ten or twelve inches long, with from seven to eleven leaflets and slender petioles which are slightly flattened and grooved on the upper side toward the base, thickly coated at first with hoary tomentum, and more or less villose in the autumn. The leaflets are lanceolate, acuminate at the apex, and finely serrate, with minute straight or incurved remote teeth, except on the upper side below the middle, which is entire. The terminal leaflet is gradually narrowed and acute at the base and short-stalked, and the lateral leaflets are often falcate, rounded or sometimes broadly cuneate on one side and narrowly cuneate on the other at the unsymmetrical base, and subsessile or short-stalked; when they unfold the leaflets are puberulous above and tomentose below, and at maturity they are thin and firm in texture, dark yellow-green and nearly glabrous on the upper surface, pale yellow-green and puberulous on the lower surface, from three to five inches long and about an inch and a half wide, with slender yellow midribs rounded and usually puberulous on the upper side toward the base, and numerous slender forked primary veins arcuate and united near the margin of the leaf, and connected by thin straight veinlets. The staminate flowers open about the first of May when the leaves are nearly a third grown, and are produced in slender villose aments from two to three inches long from buds formed in the axils of leaves of the previous year. The perianth is light yellow-green, and villose on the outer surface, with oblong-ovate rounded lobes much shorter than the ovate acuminate bract. The pistillate flowers are oblong, slightly four-angled, and villose, with an ovate bract, broadly ovate bractlets, and an ovate acute calyx-lobe. The fruit is produced in few-fruited clusters, and is oblong or oblong-obovate, acute at the ends, apiculate at the apex, slightly four-winged at the base, dark brown more or less covered with articulate hairs, and from an inch and a half to two inches long, with a thin four-valved husk. The nut is oblong-ovate or oblong-obovate, compressed, acute at the ends, short-pointed at the apex, apiculate at the base, obscurely four-angled, bright red-brown, rough and pitted, and

usually from an inch and a quarter to an inch and a half long, with a thin brittle shell, thin papery walls, and a low basal ventral partition. The seed is bitter, bright red-brown, flattened, two-lobed at the apex, with lobes about as long as the short point of their connective, rounded and slightly divided at the base, obscurely grooved on the inner face, lobed by two longitudinal grooves on the outer face, and deeply penetrated by the prominent reticulated folds of the inner surface of the wall of the nut.

Hicoria Texana grows on the bottom-lands of the streams and in the low wet woods bordering the prairies of eastern Texas, where it is common in the Gulf region for a distance of from one hundred to one hundred and fifty miles from the coast.

The wood is close-grained, tough and strong, and light red-brown, with pale brown sapwood.[1] The nuts are not eaten even by hogs, and remain on the ground through the winter.

First made known by Le Conte[2] from a tree cultivated in Georgia, and afterwards collected by Charles Wright[3] in Texas in 1848 or 1849, *Hicoria Texana* was confounded by American botanists with the allied *Hicoria Pecan* until Mr. B. F. Bush rediscovered it at Columbia on the Brazos River in 1899, and, attracted by the peculiar flattened nuts, pointed out its true characters.

[1] The specimen cut by Mr. Bush for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is twenty-six inches in diameter inside the bark and one hundred and twenty-three years old. The sapwood is four and five eighths inches in thickness, with fifty-three layers of annual growth.

[2] John Eatton Le Conte (February 22, 1784–November 21, 1860) was born near Shrewsbury, New Jersey, of a Huguenot family, his ancestor William, who left Normandy on the revocation of the edict of Nantes, having settled in New Jersey about the year 1692. John Le Conte and his brother Louis became interested in the study of natural history, and as young men spent several years in Georgia, where they had charge of a plantation belonging to their father and where they established a botanical garden. In 1817 John Le Conte entered the United States army as a captain of topographical engineers, and at the end of ten years received the brevet rank of major. His health having become seriously impaired during a military expedition to the St. John's River in Florida, he visited Paris in 1827, and five years later, resigning his commission in the army, settled in New York, where he remained until 1852, and then moved to Philadelphia, where he died. Le Conte published a number of papers on botany and zoölogy, principally in the *Annals of the Lyceum of Natural History of New York* and in the *Proceedings of the Academy of Natural Sciences of Philadelphia*. Of his botanical papers the most important are on *The Species of Paspalum of the United States*, published in 1820, on *Utricularia*, *Gratiola*, and *Ruellia*, published in 1824, on *Tillandsia* and *Viola*, published in 1826, on *Pancratium*, published in 1828, on *The Vines of North America*, published in 1852–53, on *Magnolia pyramidata*, published in 1854–55, and on *Nicotiana*, published in 1859. His large herbarium was presented to the Philadelphia Academy of Sciences in 1852.

Lecontea, a genus of Madagascar Rubiaceæ, was dedicated by Achille Richard to this refined, scholarly, and liberal man. (See Asa Gray, *Bot. Gazette*, viii. 197.)

[3] See i. 94.

EXPLANATION OF THE PLATE.

PLATE DCCXIX. HICORIA TEXANA.

1. A flowering branch, natural size.
2. A staminate flower, rear view, enlarged.
3. A staminate flower, front view, enlarged.
4. An anther, enlarged.
5. A pistillate flower, enlarged.
6. End of a fruiting branch, natural size.
7. A nut, natural size.
8. Cross section of a nut, natural size.
9. A young leaf, natural size.
10. A winter branchlet, natural size.

C.E. Faxon del.

Iartaud sc.

HICORIA TEXANA, Sarg.

A. Riocreux dirext.

Imp. J. Taneur, Paris.

HICORIA CAROLINÆ-SEPTENTRIONALIS.

Shagbark Hickory.

LEAFLETS usually 5, lanceolate. Fruit subglobose; nut ovate, compressed, angled, thin-shelled, nearly white or pale brown.

Hicoria Carolinæ-septentrionalis, Ashe, *Notes on the Hickories of the United States* (1896); *Bull.* No. 6, *North Carolina Geolog. Surv.* 20; *Bot. Gazette*, xxviii. 271. — Britton & Brown, *Ill. Fl.* iii. 511, f. 1154 a. — Mohr, *Contrib. U. S. Nat. Herb.* vi. 463 (*Plant Life of Alabama*). — Britton, *Man.* 324. — Gattinger, *Fl. Tennessee*, 65.

A tree, on moist bottom-lands sometimes eighty feet in height, with a trunk from two to three feet in diameter, and short small branches which form a narrow oblong head, or on dry hillsides usually not more than twenty or thirty feet tall, with a trunk which generally does not exceed a foot in diameter.[1] The bark of the trunk is light gray, from one quarter to one half of an inch in thickness and separates freely into thick strips which are often a foot or more long and three or four inches wide and which do not fall for a long time, giving to the trunk the shaggy appearance of the northern Shagbark Hickory. The terminal winter-buds are ovate, gradually narrowed to the obtuse apex, and about a quarter of an inch long, with glabrous bright red-brown lustrous acute and apiculate strongly keeled spreading outer scales and accrescent obovate inner scales which when fully grown are bright yellow and sometimes two inches in length and long-pointed. The axillary buds are oblong, obtuse, and not more than a sixteenth of an inch long. The leaves vary from four to eight inches in length and are composed of slender glabrous nearly terete petioles, and usually five but occasionally three leaflets, the terminal short-stalked and the lateral sessile. The leaflets are lanceolate, acuminate and long-pointed at the apex, gradually narrowed at the base, which is acuminate and symmetrical, or rounded on the upper side and unsymmetrical, and coarsely serrate, with incurved teeth which are ciliate on the margins with long white caducous hairs when the leaves unfold; at maturity the leaflets are thin, dark green on the upper surface, and pale yellow-green and lustrous on the lower surface, the three upper being three or four inches long, from an inch to an inch and a half wide, and about twice as large as those of the lower pair. In the autumn the leaves turn dull brown or yellow-brown some time before falling. The flowers appear from the middle to the end of April when the leaves are nearly fully grown. The staminate flowers are borne in ternate slightly villose pedunculate aments from the base of the shoots of the year; they are pedicellate, glandular-hirsute on the outer surface, with four stamens, and are much shorter than their linear acuminate villose bracts. The pistillate flowers, which are produced in usually two-flowered spikes, are oblong and covered with clustered articulate golden hairs, and their bract is linear and ciliate on the margins. The fruit is broader than it is high, or short-oblong, and is slightly depressed at the apex, from three quarters of an inch to an inch and a half wide, dark red-brown, and roughened by small pale lenticels, with a husk which varies from one eighth to nearly three eighths of an inch in thickness and splits freely almost to the base. The nut is ovate, compressed, prominently four-angled, acute at the ends, nearly white or pale brown, and from three quarters of an inch to an inch long, with a thin shell and a large sweet seed.

Hicoria Carolinæ-septentrionalis grows on dry limestone hills and on river-bottoms, and is dis-

[1] According to Small (*in litt.*) *Hicoria Carolinæ-septentrionalis* in limestone soil on the bottoms of Chickamauga Creek near Chattanooga, Tennessee, grows to a height of more than one hundred feet and forms a trunk four feet in diameter. I have not seen such specimens. *Hicoria ovata* and *Hicoria laciniosa* grow to a great size on the alluvial bottoms of this stream.

tributed from southern Dakota and central North Carolina to northern Georgia and through western North Carolina to eastern Tennessee and central Alabama. Very abundant in all this region, it is easily recognized by its slender branchlets and small buds, and in the autumn by the peculiar brown color which the leaves assume several weeks before falling and which makes it easy to distinguish this tree from a distance.

The wood is hard, strong, very tough, and light reddish brown, with thin nearly white sapwood.[1]

Probably long confounded with *Hicoria ovata*, the Shellbark Hickory of the north, which in the southern Appalachian foothill region grows usually only on bottom-lands, the characters of *Hicoria Carolinæ-septentrionalis* were first pointed out by Mr. W. W. Ashe.[2]

[1] Two trees of this species were cut near Rome, Georgia, by Mr. C. L. Boynton for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, in the autumn of 1898; one was fourteen inches in diameter inside the bark and one hundred and forty-six years old, with sapwood which was three inches thick and composed of thirty-one layers of annual growth; the other was twenty and one quarter inches in diameter inside the bark and one hundred and ninety-four years old, with sapwood which was two and seven eighths inches in thickness and composed of sixty-eight layers of annual growth.

[2] See xiii. 149.

EXPLANATION OF THE PLATE.

PLATE DCCXX. HICORIA CAROLINÆ-SEPTENTRIONALIS.

1. A flowering branch, natural size.
2. A staminate flower, side view, enlarged.
3. A staminate flower seen from below, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A nut, natural size.
7. A nut, natural size.
8. A winter branchlet, natural size.

C.E. Faxon del.

Rapine sc.

HICORIA CAROLINÆ-SEPTENTRIONALIS, Ache

A. Riocreux direx.t

Imp. J. Taneur, Paris.

HICORIA VILLOSA.

Hickory.

LEAFLETS 5 to 9, lanceolate or oblanceolate, pubescent and coated on the lower surface while young with silvery peltate scales. Fruit subglobose or pyriform; husks thin; nut small, angled, thick-shelled.

Hicoria villosa, Ashe, *Bull. Torrey Bot. Club*, xxiv. 481 (1897); *Bull.* No. 6, *North Carolina Geolog. Surv.* 21. — Britton & Brown, *Ill. Fl.* iii. 512, f. 1156 a. — Mohr, *Contrib. U. S. Nat. Herb.* vi. 462 (*Plant Life of Alabama*). — Britton, *Man.* 325.

Hicoria glabra, var. **villosa**, Sargent, *Silva N. Am.* vii. 167, t. 355 (1895). — Ashe, *Hickories of the United States.*

Hicoria pallida, Ashe, *Hickories of the United States* (1896); *Garden and Forest*, x. 304, f. 39. — Britton, *Man.* 325.

Hicoria villosa pallida, Britton & Brown, *Ill. Fl.* iii. 512 (1898).

A tree, usually not more than eighteen or twenty but sometimes forty or fifty feet in height, with a short trunk from twelve to eighteen inches in diameter, and small branches, the upper ascending and forming a narrow oblong head and the lower pendulous. The bark of the trunk is from one half to three quarters of an inch in thickness, light gray or grayish brown, and irregularly divided by deep fissures into broad connected ridges covered with closely appressed scales. The branchlets are slender, coated when they first appear with pale tomentum or pubescence mixed with silvery peltate scales which also occur on the under surface of the leaves and on the staminate inflorescence; during their first winter they are glabrous or puberulous, bright purplish brown, and marked by occasional oblong light gray lenticels, and rather dark-colored the following year. The terminal buds are sessile or stalked, ovate, acute, and from one eighth to nearly one quarter of an inch long, with imbricated scales puberulous and more or less covered on the outer surface with yellow glands. The leaves vary from six to ten inches in length, and are composed of slender petioles which are pubescent in the spring and furnished with conspicuous tufts of pale or brownish hairs, and are glabrous or puberulous in the autumn, and of from five to nine but usually seven leaflets; these increase in size from the lowest to the upper pair, and are sessile or very short-stalked, lanceolate or oblanceolate, acuminate, gradually or abruptly narrowed, nearly symmetrical or unsymmetrical at the entire base, and coarsely serrate above, with remote glandular incurved teeth; when they unfold they are covered with deciduous resinous globules, and on the lower surface with soft hairs and with the peltate silvery scales which are characteristic of this tree in early spring, and which soon become indistinct and often disappear by the time the leaves are fully grown; at maturity they are dark green and glabrous above, pale or bright yellow below, the largest from four to five inches long and from an inch to an inch and a half wide and more than twice as large as those of the lowest pair, with stout midribs and slender primary veins pubescent or tomentose below. The staminate flowers are produced in ternate hairy catkins from five to seven inches in length, with large acute scarious bracts, and are villose on the outer surface, with hairy anthers and elongated linear acuminate villose bracts. The pistillate flowers are oblong, prominently four-ribbed, and coated with scurfy yellow pubescence, with a lanceolate acuminate bract much longer than the ovate acute bractlets and the calyx-lobe. The fruit varies from subglobose to pyriform and from three quarters of an inch to an inch and three quarters in length, and is four-winged and more or less thickly covered with yellow scurfy scales, with a thin husk which splits to below the middle or nearly to the base. The nut

is slightly angled, often somewhat compressed, narrowed at the ends, and pale or light brown, with a thick shell and small sweet seed.[1]

Hicoria villosa inhabits sandy plains or sterile rocky ridges and is distributed from southern New Jersey[2] to eastern Florida,[3] and from the valley of the Meramec River in Missouri to eastern Texas.[4] It is the common Hickory on the sandy soil of southern Delaware, where it sometimes begins to bear fruit when only a few feet high; and it is very abundant in the foothill region of the southern Appalachian Mountains and in southern Missouri and Arkansas, where on the dry flinty soil of low hills it is often the only Hickory-tree.

The wood of *Hicoria villosa* is hard, tough, rather brittle, and dark red-brown, with thick nearly white sapwood.[6]

[1] When the seventh volume of this work was published in 1895 this Hickory had been recognized only on the hills near Allenton, Missouri. The silvery scales on the young leaves and branchlets, which make this tree so conspicuous in early spring, are less noticeable in the Allenton trees than on those in some other parts of the country, and they were thought to be a form of the Pignut, *Hicoria glabra* (see vii. 167, t. cclv.). Now that this Hickory is known to be widely distributed and common in many parts of the country and its characters are better understood, I follow Mr. W. W. Ashe, who first noticed it in the east, in considering it a well marked species.

[2] *Hicoria villosa* was found by Mr. W. M. Canby near Cape May Court House, New Jersey, July 3, 1899, and by W. M. Canby, John Muir, and C. S. Sargent, near Millsborough, Delaware, in October, 1898.

[3] *Hicoria villosa* was collected by A. H. Curtiss at Oak Hill, Volusia County, Florida, July 31, 1900.

[4] The most southern stations in the Piedmont region where I have seen *Hicoria villosa* are Birmingham and Tuscaloosa, Alabama.

[5] *Hicoria villosa* was found near Houston, Texas, April 17, 1900 by Mr. B. F. Bush.

[6] The specimen of *Hicoria villosa* cut near Biltmore, North Carolina, for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is nine inches in diameter inside the bark and one hundred and forty-two years old, with forty-eight layers of sapwood, which is an inch and seven eighths in thickness.

QUERCUS ELLIPSOIDALIS.

LEAVES oval to obovate-orbicular, 5 to 7-lobed, dark green and lustrous on the upper surface.

Quercus ellipsoidalis, E. J. Hill, *Bot. Gazette*, xxvii. 204, t. 2, 3 (1899). — Britton, *Man.* 334.

Quercus coccinea, Sargent, *Silva N. Am.* viii. 133 (in part) (not Muenchhausen), t. 413, f. 2 (1895).

A tree, sixty or seventy feet in height, with a short trunk rarely three feet in diameter, and much forked branches which are ascending above and often pendulous low on the stem, and form a narrow oblong head. The bark of the trunk is comparatively thin, internally light yellow, close, rather smooth, divided by shallow connected fissures into thin narrow plates, dark brown near the base, dull gray above, and on the large branches gray-brown and only slightly furrowed. The branchlets are slender, covered with matted pale hairs when they first appear, bright reddish brown, and marked by small dark lenticels during their first year, and dark gray-brown or reddish brown in their second season. The winter-buds are ovate, obtuse, or acute, sometimes slightly angled, and about an eighth of an inch long, with ovate or oval red-brown lustrous slightly puberulous outer scales ciliate on the margins. The leaves vary from oval to obovate-orbicular in outline, and are truncate or broadly cuneate at the base, and deeply divided by wide sinuses rounded at the bottom into five or seven oblong lobes repandly dentate at the apex, with slender bristle-pointed teeth, or often, particularly those of the upper lateral pair, repandly lobulate; when they unfold they are slightly tinged with red and coated with thick hoary tomentum, and soon becoming glabrous with the exception of small tufts of pale hairs in the axils of the principal veins, at maturity they are thin and firm, bright green and lustrous on the upper surface, paler and sometimes entirely glabrous on the lower surface, from three to five inches long and from two inches and a half to four inches wide, with stout midribs and primary veins rounded on the upper side, and slender lateral veins connected by prominent reticulate veinlets; they are borne on slender grooved glabrous or rarely puberulous petioles from an inch and a half to nearly two inches long, and late in the autumn before falling turn yellow or pale brown more or less blotched with red or purple. The flowers open when the leaves are about one quarter grown, the staminate in puberulous aments from an inch and a half to two inches long, and the pistillate on stout tomentose one to three-flowered peduncles. The calyx of the staminate flower is membranaceous, campanulate, usually tinged with red, from two to five-lobed or parted into oblong-ovate or rounded segments which are smooth or slightly villose, fringed at the apex with long twisted hairs, and about as long as the stamens. These are composed of short filaments and oblong anthers cordate at the base and blunt or emarginate and sometimes apiculate at the apex. The pistillate flower is red, with broad hairy oblong acute involucral scales, a four to seven-lobed tubular campanulate calyx ciliate on the margins, three spreading or recurved styles hairy near the base, and enlarged dark slightly two-lobed stigmas. The acorn, which ripens in the autumn of its second year, is short-stalked or nearly sessile, and solitary or in pairs, and from three quarters of an inch to an inch long; the nut is ellipsoidal, varying from cylindrical to subglobose, chestnut-brown, often striate, and puberulous, with a thin shell lined with a thick coat of pale tomentum; the cup, which incloses from one third to rather more than one half of the nut, is turbinate or cup-shaped, gradually narrowed at the base, thin, light red-brown and puberulous on the inner surface, and covered on the outer surface with narrow ovate obtuse or truncate brown pubescent closely appressed scales, and a thin hyaline deeply lobed margin.

Mo. Bot. Garden
1903.

Quercus ellipsoidalis grows in the neighborhood of Chicago, Illinois,[1] and ranges to eastern Iowa[2] and southeastern Minnesota.[3]

[1] This tree was first noticed in the suburbs of Chicago by Dr. E. J. Hill in the autumn of 1891 at Gardner's Park near the southern limits of the city. Here it grows on an ancient beach of Lake Michigan in thin sandy soil overlaying a heavy clay. South of the Calumet River, near Halsted Street, it spreads over an area of several acres, growing on clay soil with *Quercus rubra*, and it is common at Glenwood, where it is associated with *Quercus coccinea* and *Quercus velutina*, and where it grows also on clay soil.

[2] *Quercus ellipsoidalis* was collected by William D. Barnes in 1895 at Big Rock, Scott County, Iowa. (See E. J. Hill, *Bot. Gazette*, xxviii. 215.)

[3] I first saw this Oak, which had been collected by Engelmann at the Falls of Minnehaha in September, 1878, at Brainerd on the Red River of the North, and near St. Paul, in September, 1882. At various times I have considered it an extreme form of both *Quercus coccinea* and of *Quercus velutina*, and as a possible natural hybrid between these species. Now that it is known to be much more generally distributed than I formerly supposed and to remain constant in its characters in widely separated regions, the idea of recent hybrid origin will have to be abandoned, and I am glad to follow Dr. Hill and consider it a species which possesses some of the characters of *Quercus velutina*, *Quercus coccinea*, and *Quercus palustris*. As Dr. Hill has pointed out, like *Quercus palustris* it has comparatively smooth bark, pendulous lower branches long-persistent on the trunk, and deeply lobed leaves. The dark color of the bark near the base of the trunk, the yellow color of the inner bark, the coarse-grained wood, the tufts of hairs in the axils of the leaves, and the dull color of the autumn foliage, suggest *Quercus velutina*. The bark, however, is much less rough and lighter colored than that of the Black Oak. The inner bark is of a lighter yellow color, and the winter-buds are much smaller and only slightly pubescent, not tomentose, and the fruits are of a different shape. From *Quercus coccinea* it differs in its smooth bark, pubescent buds, in the autumn color of the leaves, in the shape of the fruit, and in the character of the cup-scales.

A fruit of *Quercus ellipsoidalis* appears on the plate of *Quercus coccinea* in this work (viii. t. ccccxiii. f. 2).

EXPLANATION OF THE PLATE.

PLATE DCCXXI. QUERCUS ELLIPSOIDALIS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.

5, 6, and 7. Acorns, natural size.

C.E.Faxon del.

Rabouille sc.

QUERCUS ELLIPSOIDALIS, Hill.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

QUERCUS PAGODÆFOLIA.

Swamp Spanish Oak. Red Oak.

LEAVES oval to oblong, deeply 5 to 11-lobed, white-tomentose on the lower surface.

Quercus pagodæfolia, Ashe, *Bot. Gazette*, xxiv. 375 (1897). — Mohr, *Contrib. U. S. Nat. Herb.* vi. 472 (*Plant Life of Alabama*). — Britton, *Man.* 334.

Quercus falcata, var. b pagodæfolia, Elliott, *Sk.* ii. 605 (1821).

Quercus digitata pagodæfolia, Ashe, *Handb. N. Car.* 47 (1896).

A tree, sometimes one hundred and twenty feet in height, with a trunk four or five feet in diameter, and heavy branches which in the forest form a short narrow crown; or when the tree has grown uncrowded on the bank of a river wide-spreading or ascending and forming a great open head. The bark of the trunk is an inch in thickness and is roughened by small rather closely appressed plate-like scales which are light gray or gray-brown. The branchlets are slender, coated when they first appear with thick hoary tomentum, tomentose or pubescent during their first winter, and dark reddish brown and puberulous during their second year. The winter-buds are ovoid, acute, often prominently four-angled, and about a quarter of an inch in length, with light red-brown puberulous scales sometimes ciliate at the apex. The leaves vary from oval to oblong and are gradually narrowed and cuneate or full and rounded or rarely truncate at the base, and deeply divided usually by wide sinuses rounded at the bottom into from five to eleven lobes; these are acuminate, bristle-pointed, usually entire or rarely repandly dentate toward the apex, often falcate, and spread at right angles to the midrib or are pointed toward the apex of the leaf; when they unfold the leaves are coated with pale tomentum which is thickest on the lower surface, and are dark red on the upper surface, and at maturity they are dark green and very lustrous above, pale and tomentose below, from six to eight inches long and five or six inches wide; they are borne on stout pubescent or tomentose petioles from an inch and a half to two inches in length, with stout midribs rounded and usually puberulous on the upper side, slender primary veins arching to the points of the lobes, and conspicuous reticulate veinlets. The stipules are linear, villose, and caducous. In the autumn the leaves often turn bright clear yellow before falling. The flowers appear with the unfolding of the leaves, the staminate in clustered slender villose aments two or three inches long, and the pistillate on one to three-flowered tomentose peduncles. The calyx of the staminate flower is thin, scarious, pubescent on the outer surface, more or less deeply tinged with red, and divided into four or five rounded segments shorter than the stamens, which are four or five in number, with oblong emarginate yellow anthers. The involucral scales of the pistillate flower are coated with thick hoary tomentum and are about as long as the acute calyx-lobes; the stigmas are clavate, slightly lobed at the apex, and dark red. The acorn ripens in the autumn of its second year and is short-stalked or nearly sessile; the nut varies from short-ovate to subglobose, and is light yellow-brown, puberulous particularly toward the rounded apex, and about five eighths of an inch in diameter, with a thin shell lined with pale tomentum tinged with red; the cup, which incloses nearly one half of the nut, is flat on the bottom or slightly turbinate, with a thin somewhat lobed margin, and is glabrous on the inner surface and covered on the outer surface with oblong rather loosely imbricated scales which are rounded at the gradually narrowed apex and coated except on their dark margins with pale pubescence.[1]

[1] I first saw this tree on the bottoms of the White River near Mt. Carmel, Illinois, in 1894, and allusion to it was made in the eighth volume of this work published the following year under the description of *Quercus digitata*, to which it is closely related. (See,

Quercus pagodæfolia inhabits rich bottom-lands and the alluvial banks of streams, and is distributed from southeastern Virginia[1] to northern Florida,[2] and through the Gulf states and Arkansas[3] to southern Missouri, western Tennessee and Kentucky, and southern Illinois and Indiana, and is probably most abundant in the river-swamps of the Yazo basin and of eastern Arkansas, of which it is one of the largest and most valuable timber-trees.

The wood of *Quercus pagodæfolia* is light reddish brown and unusually close-grained for that of one of the Black Oaks, with comparatively small open ducts and thin sapwood, and is valued by lumbermen almost as highly as white oak.[4]

Quercus pagodæfolia is one of the largest American Oaks; and few North American trees are more beautiful either in the dense forests which cover the alluvial bottom-lands of the Mississippi basin, where its tall shafts tower high above its humbler companions, or on the banks of the Congaree or the Savannah, where its great branches spread far from the massive trunk and the ample leaves fluttering in the wind display first the dark green and then the silvery whiteness of their two surfaces.

also, Ridgway, *Proc. U. S. Nat. Mus.* v. 80; xvii. 413. — *Garden and Forest*, viii. 101, f. 16.) Later Mr. W. W. Ashe found this Oak-tree near Raleigh, North Carolina, and has shown that it is the *Quercus falcata*, var. *pagodæfolia*, of Elliott. The character of the bark and wood and the shape of the leaves with their silvery white lower surface serve to distinguish this tree from all the forms of *Quercus digitata*. That tree grows only on dry and usually sterile uplands, while *Quercus pagodæfolia* is a constant inhabitant of river-bottoms often inundated during several months of every year and of rich river banks, in all the great region which it is now known to inhabit, and I follow Mr. Ashe in considering it a species.

[1] *Quercus pagodæfolia* was collected near Virginia Beach, Virginia, in May, 1900, by Mr. C. E. Faxon.

[2] *Quercus pagodæfolia* was collected by Mr. A. H. Curtiss near Chattahoochee, Florida, September, 1884.

[3] *Quercus pagodæfolia* was collected at Fulton, Arkansas, in May, 1900, by Mr. B. F. Bush (No. 243).

[4] The specimen cut near Mt. Carmel, Illinois, by Dr. J. Schneck for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is thirty-two inches in diameter inside the bark and one hundred and eight years old, with nine layers of sapwood, which is an inch and an eighth in thickness.

EXPLANATION OF THE PLATE.

PLATE DCCXXII. QUERCUS PAGODÆFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A winter branchlet, natural size.

C.E.Faxon del.

Em.Himely sc.

QUERCUS PAGODÆFOLIA, Ashe.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

BETULA KENAICA.

Red Birch. Black Birch.

STROBILES cylindrical, erect, or spreading. Leaves ovate, acute, or acuminate, cuneate at the base.

Betula Kenaica, Evans, *Bot. Gazette*, xxvii. 481 (1899).

A tree, from thirty to forty feet in height, with a trunk from twelve to twenty inches in diameter covered with thin more or less furrowed very dark brown or nearly black bark, and wide-spreading branches. The branchlets, which are rather stout and marked by numerous small pale lenticels, are bright red-brown during two or three years, and then gradually become darker. The leaves are ovate, acute, or acuminate, broadly cuneate or somewhat rounded at the entire base, and irregularly, coarsely, and often doubly serrate above, with spreading teeth; when they unfold they are puberulous on the upper surface and ciliate on the margins, with short soft white deciduous hairs, and in summer they are glabrous, dark dull green on the upper surface, pale yellow-green on the lower surface, from an inch and a half to two inches long and from an inch to an inch and three quarters wide, with slender yellow midribs, four pairs of thin primary veins, reticulate veinlets conspicuous on both surfaces, and slender petioles from three quarters of an inch to an inch in length. The scales of the staminate flowers are ovate, acute and apiculate at the apex, puberulous on the outer surface, and dark red-brown.[1] The pistillate aments are from one third to one half of an inch in length and about one sixteenth of an inch in width, and are borne on slender glandular pubescent peduncles from one half to three quarters of an inch in length, and bibracteolate, with scarious caducous bractlets; their scales are acuminate, light green, ciliate on the margins, with long white hairs, and strongly reflexed at the middle, and the styles are bright red. The strobiles are cylindrical and about an inch long, and their scales are cuneate at the base, longer than broad, and ciliate on the margins with broad lateral lobes much shorter than the oblong-ovate terminal lobe which is narrowed and rounded at the apex. The nut is oval and somewhat narrower than its thin wing.

Betula Kenaica inhabits the Kenai peninsula in the vicinity of Cook Inlet, where it grows with *Picea Sitchensis*, and Kadiak Island. It was discovered during the summer of 1897 at Sunrise near the head of Turnagain Arm of Cook Inlet by Dr. Walter H. Evans,[2] and two years later it was distinguished on Kadiak Island by Dr. F. V. Coville of the Harriman Alaska Expedition.[3]

[1] I have seen only young staminate aments of this tree collected when they were about an inch long and soon after the opening of the lowest flowers.

[2] Walter Harrison Evans (June 3, 1863) was born at Delphi, Indiana, where he was educated in the common and high schools. In 1882 he entered Wabash College at Crawfordsville, Indiana. Graduating in 1887, he took a post-graduate course in his college, becoming assistant to Dr. J. M. Coulter, at that time professor of botany, and receiving in 1890 the degree of Doctor of Philosophy. In 1891–92 Dr. Evans made collections of Cacti in the region adjacent to the boundary between the United States and Mexico for the Division of Botany of the United States Department of Agriculture, and since 1892 he has been the botanical editor of *The Experiment Station Record* published by that department. In 1897 Dr. Evans was sent to Alaska as a special commissioner to investigate the agricultural resources of the territory and to report on them to Congress. With Professor Coulter he has published *A Revision of North American Cornaceæ* in the fifteenth volume of *The Botanical Gazette*, and he is the author of a paper on *The Effect of Copper Sulphate on Seed Germination* in *Bulletin* No. 10 *of the Division of Vegetable Pathology, United States Department of Agriculture*, and of a number of miscellaneous papers.

[3] "I found *Betula Kenaica* abundant on a forested gravel point in Halibut Cove, Kachemak Bay, Cook Inlet, growing twenty-five to thirty-five feet high and a foot in diameter. There are a few trees still standing back of the village of Kadiak on Kadiak Island, and I found an abundance of them in one spot in the valley at the head of English or Woman's Bay, eight miles south of Kadiak village, the trees at this point having a maximum diameter of about one foot and a height of about twenty feet." (Coville, *in litt.*)

EXPLANATION OF THE PLATE.

PLATE DCCXXIII. BETULA KENAICA.

1. A fruiting branch, natural size.
2. A scale of the fruiting ament, enlarged.
3. A nut, enlarged.

C.E.Faxon del.

Em.Himely sc.

BETULA KENAICA, Evans.

A.Riocreux direx.t

Imp.J.Taneur, Paris.

BETULA PAPYRIFERA, var. CORDIFOLIA.

Canoe Birch.

LEAVES ovate, cordate at the base.

Betula papyrifera, var. **cordifolia**, Fernald, *Rhodora*, iii. 173 (1901).

Betula cordifolia, Regel, *Nouv. Mém. Soc. Nat. Mosc.* xiii. 86, t. 12, f. 29–36 (*Monographia Betulacearum*) (1860).

Betula alba, subsp. 6 **cordifolia**, Regel, *Bull. Soc. Nat. Mosc.* xxxviii. pt. ii. 401 (*Gattungen Betula und Alnus* [1865]); *De Candolle Prodr.* xvi. pt. ii. 166.

Betula papyrifera, β **minor**, Gray, *Man.* ed. 5, 459 (in part) (not Tuckerman) (1867).

Betula papyrifera, var. **minor**, Watson & Coulter, *Gray's Man.* ed. 6, 472 (1890). — Sargent, *Silva N. Am.* ix. 57. — Britton & Brown, *Ill. Fl.* i. 509. — Britton, *Man.* 328.

Betula papyracea, a **cordifolia**, Dippel, *Handb. Laubholzk.* ii. 177 (1892).

On the slopes of Mt. Katahdin in Maine and on the White Mountains of New Hampshire the Canoe Birch is usually not more than thirty or forty feet in height, and at the highest elevations which it reaches on these mountains it is reduced to a low shrub. The leaves of this mountain tree are cordate at the base, and farther north, and in the northern Rocky Mountain region where the Canoe Birch is not common, the leaves are sometimes cordate and sometimes wedge-shaped at the base. On plate ccccli. of this work the ordinary form of the Canoe Birch with leaves broadly cuneate at the base is figured, and properly to illustrate this species a figure of this well-marked alpine, northern and western form is needed. Except in the form of the leaves, there seems to be no other constant characters by which the variety *cordifolia* can be separated from the typical Canoe Birch.[1]

[1] A confusion which has existed in the name of this Birch is due to the fact that two plants have been confounded in the *Betula papyracea*, var. *minor*, of Tuckerman, as shown by Mr. Fernald in his *Catalogue of the Vascular Plants of Mt. Katahdin* (*Rhodora*, iii. 173). Mr. Fernald identifies Tuckerman's specimens in Herb. Gray of *Betula papyracea*, var. *minor* (*Am. Jour. Sci.* xlv. 31 [1843]), with the plant which Regel has called *Betula alba*, subsp. 8 *tortuosa* (*Bull. Soc. Nat. Mosc.* xxxviii. pt. ii. 404 [*Gattungen Betula und Alnus*] [1865]; *De Candolle Prodr.* xvi. pt. ii. 168), an Old World plant, while American botanists previously had considered the dwarf form of the Canoe Birch to be Tuckerman's plant. Regel's name, *cordifolia*, therefore, based in part on specimens collected on Mt. Katahdin in 1846, should be adopted for this variety.

EXPLANATION OF THE PLATE.

PLATE DCCXXIV. BETULA PAPYRIFERA, var. CORDIFOLIA.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. A scale of a fruiting ament, enlarged.
4. A nutlet, enlarged.

C.E. Faxon del.

Iartaud sc.

BETULA PAPYRIFERA, VAR. CORDIFOLIA, Regel.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

BETULA OCCIDENTALIS.

Birch.

STROBILES cylindrical, pendulous. Leaves ovate, acuminate, rounded or cordate at the broad base.

Betula occidentalis, Hooker, *Fl. Bor.-Am.* ii. 155 (in part) (1839). — Spach, *Ann. Sci. Nat.* sér. 2, xv. 197 (*Revisio Betulacearum*) (in part). — Lyall, *Jour. Linn. Soc.* vii. 134. — Sargent, *Bot. Gazette*, xxxi. 237.

Betula alba, subsp. 5 **occidentalis**, α **typica**, Regel, *Bull. Soc. Nat. Mosc.* xxxviii. pt. ii. 400 (*Gattungen Betula und Alnus*) (in part) (1865); *De Candolle Prodr.* xvi. pt. ii. 165 (in part).

Betula papyrifera, Macoun, *Cat. Can. Pl.* 436 (in part) (1886). — Sargent, *Silva N. Am.* ix. 57 (in part).

A tree, from one hundred to one hundred and twenty feet in height, with a trunk three or four feet in diameter, and comparatively small branches which while the tree is young are slightly ascending and form a narrow symmetrical pyramidal crown, and on old trees are often pendulous. The bark is thin, marked by large oblong horizontal dark-colored raised lenticels, light orange-brown, very lustrous, and separates freely into thin papery layers which disclose in falling the bright orange-yellow inner bark. The branchlets are stout, and when they first appear are pale orange-brown, more or less glandular, and coated with long pale hairs; during their first winter they are bright orange-brown marked by numerous minute pale lenticels, pubescent or puberulous, and nearly destitute of glands, and in their second year they are orange-brown, glabrous, very lustrous, and the lenticels begin to lengthen horizontally. The winter-buds are acute, bright orange-brown, and from one eighth to one quarter of an inch in length, and in expanding the inner scales, which are obovate or oblong, rounded at the apex, light yellow-brown, and scarious, sometimes become three quarters of an inch long. The leaves are ovate, acute, usually rounded but occasionally cordate or rarely cuneate at the broad base, and coarsely and generally doubly serrate, with straight or incurved glandular teeth; when they unfold they are light yellow-green covered with dark reddish resinous viscid glands and villose along the midribs and veins, with long white hairs which are most abundant on their lower side and in the axils of the primary veins, where they often form large tufts which are persistent during the summer; at maturity they are thin but firm in texture, marked by the scars of the fallen glands, dull dark green on the upper surface, pale yellow-green on the lower surface, and puberulous on both sides of the stout yellow midribs and five or six pairs of slender primary veins, from three to four inches long and from an inch and a half to two inches wide; they are borne on stout glandular grooved petioles at first tomentose, ultimately pubescent or puberulous, and about three quarters of an inch in length. The stipules are oblong-obovate, rounded, or acute and apiculate at the apex, ciliate on the margins, with short white hairs, puberulous, glandular-viscid, about half an inch long and from an eighth to a quarter of an inch wide. During the winter the staminate aments are about three quarters of an inch long and an eighth of an inch thick, with ovate scales rounded or abruptly narrowed and acute at the apex, puberulous on the outer surface, and ciliate on the margins, with long scattered pale hairs, and when they are fully grown and the flowers have opened in May they are from three to four inches long and about a quarter of an inch wide. The strobiles, which are produced on stout peduncles about three quarters of an inch long, are cylindrical, from an inch and a quarter to an inch and a half in length and from a quarter to a half of an inch in thickness; their scales are much longer than they are broad, gradually narrowed to the base, puberulous on the outer surface, and ciliate on the margins, with spreading lateral lobes, and an elongated terminal

lobe rounded at the narrow apex. The nut is oval, about a sixteenth of an inch long, and nearly as wide as its wings.[1]

Betula occidentalis inhabits the banks of streams and lakes in southwestern British Columbia and northwestern Washington, and nowhere very common grows probably to its largest size on the alluvial banks of the lower Fraser River.[2]

Betula occidentalis is one of the largest of all Birch-trees, and, with the exception of the Cottonwood, it is the largest of the deciduous-leaved trees of northwestern North America. It was discovered on the shores of the Straits of Fuca by Dr. John Scouler[3] between 1825 and 1827. In 1893 this tree was introduced into the Arnold Arboretum, where it has grown very rapidly and is perfectly hardy and where it already displays the orange-brown bark which best distinguishes it from the Canoe Birch of the east.

[1] In the ninth volume of this work published in 1896, while calling attention to the color of the bark of this tree, I considered it a western form of *Betula papyrifera*. Since the publication of that volume I have had an opportunity to see this tree again on Vancouver Island and to compare the young plants in the Arnold Arboretum with plants of the Canoe Birch of the same age. These are so distinct in their bark, and in the color of the branchlets, which on the western tree are orange-brown and bright red-brown on the eastern tree, that it is not possible to consider them forms of the same species.

From *Betula papyrifera* it can also be distinguished by the shape of the leaves, which are broad or rounded or on vigorous shoots slightly cordate, not cuneate at the base, and by the shorter and broader strobiles, with puberulous scales ciliate on the margins, the scales of *Betula papyrifera* being usually glabrous and destitute of marginal hairs, although on specimens which I collected several years ago on Prince Edward's Island the scales are sometimes puberulous.

Betula occidentalis was first described by Hooker from the specimens collected near the Straits of Fuca by Dr. Scouler, although with them he united a specimen collected by Douglas in the interior west of the Rocky Mountains. The tree from the Straits of Fuca appeared first in the description of *Betula occidentalis* which was evidently drawn principally from the specimens of that tree and must therefore be considered the type of Hooker's species, while the second specimen included in this description appears to be one of the forms of *Betula papyrifera*.

In the ninth volume of this work (65, t. ccccliii.) the half shrubby dark-barked Birch with spreading gracefully drooping stems which is common in eastern Washington and Oregon, and ranges as far south as Colorado, Utah, and northern California, was confounded with *Betula occidentalis* of Hooker and was described and figured under that name. This plant was collected by Nuttall on the Sweet Water, one of the branches of the Platte, and was first described and figured by him as *Betula occidentalis*. (See *Sylva*, i. 23, t. 7.) Torrey in *Frémont's Report* repeated this error. This same species was also described and figured in *King's Report* (v. 323, t. 35) as *Betula occidentalis* by Watson, who repeated his error in *The Botany of California*, and it is this plant which is described and figured as *Betula occidentalis* in the ninth volume of *The Silva of North America*, where an allusion only is made to the true *Betula occidentalis* of the coast in a note under *Betula papyrifera*.

Nuttall found another small Birch in the Rocky Mountain region and on the plains of the Columbia which he described and figured as *Betula rhombifolia* in the first volume of his *Sylva* published in 1842. This plant, judging by one of Nuttall's original specimens in the Gray Herbarium, is the slender-fruited form of the plant described by Nuttall as *Betula occidentalis*, which is common in eastern Oregon and Washington and ranges eastward into Montana and Idaho. If the two forms, which seem to vary only in the thickness of the aments, really belong to one species this would have to bear Nuttall's name of *Betula rhombifolia* had not Tausch four years earlier than Nuttall used that name for a European species. Some of the specimens of the tree called *Betula occidentalis* by Nuttall and Watson bear a strong resemblance to a fragmentary specimen in the Gray Herbarium of the Asiatic *Betula microphylla*, Bunge, but the evidence of this specimen would hardly seem to warrant the adoption of Bunge's name for our tree, for which I have proposed the name of *Betula fontinalis*. (See *Bot. Gazette*, xxxi. 239.)

[2] The most eastern place from which I have seen a specimen of *Betula occidentalis* is Donald on the Columbia River in British Columbia in about longitude 118° west, where it was collected in 1885 by Mr. John Macoun.

[3] ix. 66.

EXPLANATION OF THE PLATE.

PLATE DCCXXV. BETULA OCCIDENTALIS.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. A scale of a fruiting ament, enlarged.
4. A scale of a fruiting ament, enlarged.
5. A nut, enlarged.

C.E.Faxon del.

Himely sc.

BETULA OCCIDENTALIS, Hook.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

BETULA ALASKANA.

White Birch.

STROBILES cylindrical, pendulous. Leaves rhomboidal to deltoid, ovate, acuminate.

Betula Alaskana, Sargent, *Bot. Gazette*, xxxi. 236 (April, 1901).

Betula alba, subsp. **verrucosa**, var. **resinifera**, Regel, *Bull. Soc. Nat. Mosc.* xxxviii. pt. ii. 398 (*Gattungen Betula und Alnus*) (in part) (1865); *De Candolle Prodr.* xvi. pt. ii. 164.

Betula resinifera, Britton, *Bull. N. Y. Bot. Gard.* ii. 165 (not Regel) (May, 1901).

A tree, usually from thirty to forty but occasionally eighty feet in height, with a trunk from six to twelve inches in diameter, and slender erect and spreading or pendulous branches. The bark of the trunk, which is thin and marked by numerous elongated horizontal dark and only slightly raised lenticels, is dull, pale reddish brown or sometimes nearly white on the outer surface, light red on the inner surface, close and firm, and finally separable into thin plate-like scales. The branchlets are slender, glabrous, bright red-brown, more or less thickly covered during their first year with resinous glands which do not always entirely disappear until the second or third season, when the branchlets are lustrous and marked by numerous small pale lenticels. The winter-buds are ovate, obtuse at the gradually narrowed apex, and about a quarter of an inch in length, with light red-brown and shining outer scales sometimes ciliate on the margins, with long white hairs, and oblong rounded scarious inner scales which are hardly more than half an inch long when fully grown. The leaves vary from rhomboidal to deltoid-ovate, and are acuminate and long-pointed at the apex, truncate, rounded or broadly cuneate or on leading shoots occasionally cordate at the entire base, and coarsely and often doubly glandular-serrate above; when they unfold they are yellow-green and covered with resinous glands, lustrous and villose above, with long scattered pale hairs, and slightly puberulous below; and at maturity they are thin, dark green on the upper surface, pale and yellow-green on the lower surface, from an inch and a half to three inches long and from an inch to an inch and a half wide, with slender midribs and primary veins pubescent or ultimately glabrous below, and slender often bright red petioles which are at first somewhat hairy but finally glabrous and about an inch in length. The stipules are oblong, gradually narrowed and rounded at the ends, and villose particularly toward the margins. The aments of staminate flowers are clustered, sessile, about an inch long, and an eighth of an inch thick, and their scales are ovate, acuminate, puberulous on the outer surface, and light red with yellow margins. The pistillate aments are slender, cylindrical, glandular, about an inch long and an eighth of an inch thick, and are raised on stout peduncles nearly half an inch in length. The strobiles are cylindrical, spreading, or pendulous, from an inch to an inch and a quarter long, and from one third to one half of an inch thick; and their scales are almost as long as they are broad and ciliate on the margins, with erect and acute or spreading and rounded lateral lobes, much shorter than the elongated acute or acuminate terminal lobe. The nut is oval and narrower than its broad wing.[1]

Betula Alaskana is distributed from the valley of the Saskatchewan from about longitude 106°

[1] In 1858 Bourgeau collected specimens of this tree on the Saskatchewan (*teste* Herb. Gray). These specimens were referred by Regel to one of his varieties of the Old World, *Betula alba* from Udskai in eastern Siberia and from Transbaical, but the Alaskan specimens which I have sent to the Imperial Botanic Garden at St. Petersburg are pronounced by the botanist of that establishment to be unlike any of the Asiatic species, and with the scanty knowledge which now exists of many of the northern Asiatic Birches it does not seem possible to unite American and Asiatic forms until a thorough study of them can be made in the forest and the different species can be cultivated side by side.

west[1] northwestward to the coast of Alaska, along which it extends from the Lynn Canal[2] to the shores of Cook Inlet.[3] It is the common Birch-tree of the Yukon basin, where it grows sparingly near the banks of streams in forests of coniferous trees and in large numbers on sunny slopes and hillsides.[4]

In 1898 *Betula Alaskana* was introduced into the Arnold Arboretum from seeds gathered near Skaguay, Alaska.

[1] In July, 1876, *Betula Alaskana* was collected at Prince Albert on the Saskatchewan in latitude 58° north by Mr. John Macoun. In 1887 it was found by Dr. George M. Dawson on the Dease River and on the Lewis River "near the mountains."

[2] In August, 1897, *Betula Alaskana* was found at the foot of the White Pass above Skaguay at the head of the Lynn Canal, Alaska, by W. M. Canby, John Muir, and C. S. Sargent.

[3] During the summer of 1897 *Betula Alaskana* was found by Mr. W. H. Evans on the shores of Cook Inlet.

[4] *Teste* M. W. Gorman, *in litt.*

EXPLANATION OF THE PLATE.

PLATE DCCXXVI. BETULA ALASKANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A fruiting branch, natural size.
4. A scale of a fruiting ament, enlarged.
5. A nutlet, enlarged.
6. A winter branchlet, natural size.

C.E. Faxon direxit

Lartaud sc.

BETULA ALASKANA, Sarg.

A. Riocreux direxit

Imp. J. Taneur, Paris.

ALNUS SITCHENSIS.

Alder.

LEAVES ovate, acute, sinuately lobed, doubly serrate, lustrous on the lower surface. Stamens 4. Nut broadly winged.

Alnus Sitchensis.

Alnus viridis, Bongard, *Vég. Sitcha*, 44 (not De Candolle) (August, 1832); *Mém. Phys. Nat. Math.* pt. ii. *Acad. Sci. St. Pétersbourg*, ii. 162 (*Vég. Sitcha*). — Lyall, *Jour. Linn. Soc.* vii. 134. — Rothrock, *Smithsonian Rep.* 1867, 454 (*Fl. Alaska*). — Macoun, *Cat. Can. Pl.* 438.

Alnus viridis, β, Hooker, *Fl Bor.-Am.* ii. 157 (1839).

Alnaster fruticosus, Ledebour, *Fl. Ross.* iii. 655 (in part) (1849).

Alnus viridis, β **Sibirica**, b **Sitchensis**, Regel, *Nouv. Mém. Soc. Nat. Mosc.* xiii. 138 (*Monographia Betulacearum*) (in part) (1861).

Alnus viridis, δ **sinuata**, Regel, *Bull. Soc. Nat. Mosc.* xxxviii. pt. ii. 422 (*Gattungen Betula und Alnus*) (in part) (1865); De Candolle, *Prodr.* xvi. pt. ii. 183 (in part).

Alnus viridis, β **Sibirica**, Regel, *Russ. Dendr.* pt. i. 50. (in part) (1870).

Alnus occidentalis, Dippel, *Handb. Laubholzk.* ii. 158, f. 78 (1892). — Koehne, *Deutsche Dendr.* 114.

Alnus rubra, Coville, *Contrib. U. S. Nat. Herb.* iii. 345 (not Bongard) (1895).

Alnaster Alnobetula, F. Kurtz, *Bot. Jahrb.* xix. 405 (*Fl. Chilcatgebietes*) (not Schweinfurth) (1895).

Alnus tenuifolia, Sargent. *Silva N. Am.* ix. 68 (in part) (not Nuttall) (1896).

Alnus Alnobetula, Sargent, *Silva N. Am.* ix. 68 (in part) (not K. Koch) (1896).

Alnus incana, var. **virescens**, Gorman, *Pittonia*, iii. 70 (not Watson) (1896).

Alnus sinuata, Rydberg, *Bull. Torrey Bot. Club*, xxiv. 190 (1897); *Mem. N. Y. Bot. Gard.* i. 117 (*Fl. Montana*).

A tree, sometimes forty feet in height, with a trunk seven or eight inches in diameter covered with thin close blue-gray bark which is bright red internally, and short slender nearly horizontal branches forming a narrow crown; or often a shrub only a few feet tall spreading into broad thickets. The branchlets are slender and slightly zigzag, and when they first appear are puberulous and very glandular; they are bright orange-brown, lustrous, and marked by numerous large pale lenticels during their first season, much roughened during their second year by large elevated crowded leaf-scars, and light gray-brown the following year. The winter-buds are acuminate, dark purple, covered, especially toward the apex, with close fine pubescence, and about half an inch long. The leaves are ovate, acute at the apex, full and rounded, often unsymmetrical, and somewhat oblique or abruptly narrowed and cuneate at the base, divided into numerous short acute lateral lobes, and sharply and doubly serrate, with straight glandular teeth; when they unfold they are glandular-viscid, and at maturity are membranaceous, yellow-green on the upper surface, pale and very lustrous on the lower surface, and glabrous or villose along the under side of the stout midribs, with short brown hairs which usually also form tufts in the axils of the numerous slender primary veins which extend obliquely to the points of the lobes; they vary from three to six inches in length and from half an inch to four inches in width, and are borne on stout grooved petioles abruptly enlarged at the base, and from one half to three quarters of an inch in length. The stipules are oblong or spatulate, rounded and apiculate at the apex, puberulous, and about a quarter of an inch long. The aments of staminate flowers are produced in pairs in the axil of the upper leaf, which is sometimes reduced to a small bract, and singly in the axil of the leaf next below it, and are nearly sessile; appearing in summer, they are about half an inch long and an eighth of an inch wide during the winter, with dark red-brown shining apiculate puberulous scales, and when the flowers open in spring, or at midsummer at high elevations, when the leaves are nearly one third grown, they are four or five inches long, with a puberulous light red rachis and pedicels, and ovate acute apiculate three-flowered scales. The calyx is four-lobed with

rounded lobes shorter than the four stamens. The pistillate aments are produced in elongated panicles, and are inclosed during the winter in buds formed the previous summer in the axils of the leaves of short lateral branchlets, and are long-pedunculate and about a third of an inch long and a sixteenth of an inch thick. The strobiles are raised on slender peduncles, and are borne in elongated sometimes leafy panicles from four to six inches in length; they are oblong and from one half to five eighths of an inch in length and about one third of an inch in thickness, with truncate scales thickened at the apex. The nuts are oval, and about as wide as their thin wings.

Alnus Sitchensis is distributed along the northwest coast of North America from the borders of the Arctic Circle to Oregon; it is common in the valley of the Yukon, and ranges eastward through British Columbia to Alberta, and through Washington and Oregon to the western slopes of the Rocky Mountains. At the north, mingling with dwarf Willows, it forms great thickets,[1] and in southeastern Alaska it often becomes a tall slender tree on the rich moist bottom-lands near the mouths of mountain streams, or, ascending nearly to the limit of tree-growth, at high elevations is reduced to a low shrub. In the valley of the Yukon it is very abundant on the wet banks of streams, where it is often arborescent in habit,[2] and in British Columbia[3] and the United States it is generally small, growing usually only at elevations of more than three thousand feet above the level of the sea, and often forming thickets on the banks of streams and lakes.[4]

Alnus Sitchensis, which was long confounded with *Alnus Alnobetula*, the Green Alder of the northeastern states and Europe, was found in 1827 on Baranoff Island in the neighborhood of the town of Sitka[5] by K. H. Mertens.[6]

[1] Seemann, *Bot. Voy. Herald*, 17, 41. See, also, Dall, *Alaska and its Resources*, 440.

In the Gray Herbarium there are specimens of *Alnus Sitchensis* collected by John Muir at St. Michael on Norton Sound in 1881, and by M. W. Hasseyter on Popoff Island, one of the Shumagin group, in 1872.

[2] Gorman, *in litt.*

[3] *Alnus Sitchensis* was collected by Dr. George M. Dawson in 1876 on the Iltasyonco branch of the upper Fraser River. It has also been collected by J. Macoun at Hector in the Rocky Mountains, at Lake Louise, and on Rogers Pass near Glacier, on the line of the Canadian Pacific Railroad, and on Crow Mountain Pass, Alberta.

[4] In 1883 *Alnus Sitchensis* was collected by W. M. Canby and C. S. Sargent near the head of the Jocko River in Montana, and in 1892 by J. H. Sandberg on Cedar Mountain, Lahat County, Idaho. In 1880 I found this Alder on Silver Peak near Yale, British Columbia, at elevations of forty-five hundred feet above the sea, and also on the banks of the Fraser in the same region. These specimens were after referred to *Alnus tenuifolia*, Nuttall, which does not approach the coast. In 1896 I found it on the banks of the Solduc River among the Olympic Mountains of Washington, on Mt. Hood, Oregon, at high elevations, on the Blue Mountains of eastern Washington, where it is very abundant, and on the shores of Avalanche Lake, Montana, at an elevation of four thousand feet above the sea-level.

[5] It is probable that Dr. John Richardson was the discoverer of this species during his journey with Captain John Franklin to the shores of the polar sea of North America during the years 1819–22. (See Franklin, *Jour.* Appx. No. 374, as *Alnus glandulosa*.)

[6] See xii. 80.

EXPLANATION OF THE PLATE.

PLATE DCCXXVII. ALNUS SITCHENSIS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit-scale with its nuts, enlarged.
6. A nut, enlarged.
7. A leaf, natural size.

C.E.Faxon del.

Rapine sc.

ALNUS SITCHENSIS, Sarg.

A.Riocreux dirext.

Imp. J. Taneur, Paris.

SALIX BALSAMIFERA.

Willow.

LEAVES ovate or lanceolate, acute, glaucous and conspicuously reticulate-veined on the lower surface.

Salix balsamifera, Barratt, ex Hooker, *Fl. Bor.-Am.* ii. 149 (1839). — Bebb, *Bot. Gazette*, iv. 190; *Bull. Torrey Bot. Club*, xv. 121, t. 81. — Watson & Coulter, *Gray's Man.* ed. 6, 485. — Dippel, *Handb. Laubholzk.* ii. 285, f. 137. — Koehne, *Deutsche Dendr.* 97. — Sargent, *Garden and Forest*, vi. 28, f. 5. — Rand, *Garden and Forest*, vi. 105. — Britton & Brown, *Ill. Fl.* i. 504, f. 1201. — Britton, *Man.* 314.

Salix cordata, β **balsamifera**, Hooker, *Fl. Bor.-Am.* ii. 149 (1839).

Salix pyrifolia, Anderson, *Svensk. Vetensk. Akad. Handl.* ser. 4, vi. 162, t. 8, f. 93 (*Monographia Salicum*) (1867); De Candolle, *Prodr.* xvi. pt. ii. 254.

Usually a shrub often making clumps of crowded slender erect stems, generally destitute of branches except near the top and only a few feet tall, *Salix balsamifera* in a hillside bog near Fort Kent on the St. John's River in Maine becomes arborescent in habit and, growing to a height of twenty-five feet, forms a trunk twelve or fourteen inches in diameter.[1] The bark of the stem is thin, rather smooth, and of a dull gray color. The branchlets, which are comparatively stout, and glabrous during their first season, are reddish brown and lustrous or chestnut-colored when exposed to the sun, becoming olive-green the following year. The winter-buds are acute, much compressed, bright scarlet, very lustrous, and about a quarter of an inch long. The leaves are involute in the bud, ovate or ovate-lanceolate, acute or acuminate at the apex, broad and rounded and usually subcordate at the base, finely serrate, with glandular teeth, and balsamic particularly while young; when they unfold they are thin, pellucid, red, and coated on the lower surface with long slender caducous hairs, and at maturity they are thin but firm in texture, dark green above, pale and glaucous below, from two to four inches long and from an inch to an inch and a half wide, with stout yellow midribs raised and rounded on the upper side, thin primary veins and conspicuous reticulate veinlets; they are borne on stout reddish or yellow petioles from one third to one half of an inch in length, which in falling leave narrow slightly raised leaf-scars marked by three conspicuous equidistant vascular bundle-scars. The stipules, which are often wanting, are sometimes produced on vigorous shoots and are foliaceous, broadly ovate, and acute. The aments are cylindrical, from an inch to an inch and a half in length, with obovate acute rose-colored bracts coated with long white hairs, and are borne on slender leafy peduncles. There are two stamens with free filaments and reddish or ultimately yellow anthers. The ovary is narrow, ovate, gradually contracted from above the middle to the apex which is crowned with nearly sessile emarginate stigmatic lobes. The scales are persistent on the fruiting aments which vary from two inches and a half to three inches in length. The capsules are ovate-conical, long-stalked, a quarter of an inch long, and dark orange color.[2]

[1] See E. F. Williams, *Rhodora*, iii. 277.

[2] Bebb (*Bull. Torrey Bot. Club*, xv. 124) proposes these varieties:

"*Typica.* Leaves ovate, 2 to 3 inches long, short-pointed or the lower obtuse, rounded at base, at length rigid and glaucous beneath, with raised reticulate veins, minutely glandular-serrulate; fertile aments very loose, leaves of the peduncle few and large. This is the prevailing northern form.

"*Vegeta.* Leaves broadly lanceolate, 4 to 5 inches long, acute or acuminate, truncate or cordate at the base, coarsely and irregularly repand-toothed, paler beneath; aments less spreading, not so leafy at base.

"*Lanceolata.* Leaves lanceolate, 2 to 4 inches long, ½ to ¾ inch wide; aments more slender, otherwise as in *f. typica*.

"*Alpestris.* Low bush, 2 to 4 feet high; leaves small, 1 to 2 inches long, lanceolate, pointed at both ends, rather coarsely and irregularly serrate, green both sides; male ament slenderly cylindrical, less silky. Eagle Lake, Mt. Lafayette, alt. 4,200 feet; also on the coast of Labrador."

Salix balsamifera is an inhabitant of cold wet bogs and is distributed from the coast of Labrador to northern Maine, northern New Hampshire and New York,[1] and to the valley of the Saskatchewan,[2] northern Michigan,[3] and northern Minnesota.

Salix balsamifera was first collected by Mr. Henry Little[4] in August, 1823, on the bank of the Ammonoosuc River among the White Mountains of New Hampshire,[5] and was first distinguished by Joseph Barratt.[6]

In 1880 *Salix balsamifera* was introduced into the Arnold Arboretum, where it is perfectly hardy and one of the most beautiful of the shrubby Willows, particularly during the winter, when the bright scarlet buds make the shining branches conspicuous.

[1] *Salix balsamifera* was collected on the shores of Lake Placid, New York, by Mr. J. G. Jack in August, 1894.

[2] Macoun, *Cat. Can. Pl.* 445.

[3] Farwell, *Garden and Forest*, vi. 149.

[4] Henry Little (December 21, 1802–March 31, 1827) was the second child of Moses Little who was graduated from Harvard College in 1787, and studied medicine with Dr. Jonathan Swett of Newburyport. He married in 1799 Elizabeth, daughter of George Williams, a merchant of Salem, where he settled and became a prominent physician. He died in 1811 of pulmonary consumption, which proved fatal to his ten children. Henry Little was graduated from the Harvard Medical School in 1825, and his interest in botany was no doubt due to an acquaintance with Dr. Jacob Bigelow, who was connected with the school. He died during a voyage undertaken for his health. (See *The Descendants of George Little who came to Massachusetts in 1640*, No. 355, 94, by George Thomas Little.)

[5] *Teste* Bebb, *Bot. Gazette*, iv. 190. Mr. Little's White Mountain specimens were found by Bebb in the herbarium of the Academy of Natural Sciences of Philadelphia.

[6] Joseph Barratt (January 7, 1797–June 25, 1882) was born in Little Hallam, Derbyshire, England, and from 1825 to 1829 was professor of botany, chemistry, and mineralogy in the military academy at Middletown, Connecticut. He subsequently entered the Medical School of Yale College, from which he was graduated in 1834, and finally settled in Middletown, where he practiced medicine for many years and where he died. He had previously been a pupil of Torrey in the study of botany, devoting himself particularly to the genus Salix. In 1834 Dr. Barratt read before the Lyceum of Natural History of New York a Monograph of the North American Willows, which he proposed to illustrate with a figure of each species. The expense of this work caused it to be abandoned. In 1840 he published in Middletown the *Salices Americanæ; North American Willows.* In this paper twenty-nine species are arranged in eight sections. This arrangement, with Barratt's sectional characters, was adopted by Hooker in his *Flora Boreali-Americana.* This appears to be the only important botanical work accomplished by Dr. Barratt, although he made and distributed a large number of herbarium specimens of Willows. Later he devoted attention to the geology of the region adjacent to Middletown and to the study of the languages of the American Indians.

Barrattia, established on a Texas Composite now referred to *Encelia*, was dedicated to him by Asa Gray, who was his fellow-student under Torrey.

EXPLANATION OF THE PLATE.

PLATE DCCXXVIII. SALIX BALSAMIFERA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A fruiting branch of the pistillate tree, natural size.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A capsule, enlarged.
7. A leafy branch, natural size.

C.E. Faxon del.

Iartaud sc.

SALIX BALSAMIFERA, Barratt.

A Riocreux dirext.

Imp. J. Taneur, Paris.

SALIX ALAXENSIS.

Feltleaf Willow.

LEAVES usually elliptical-lanceolate and acute, covered below with a thick coat of matted lustrous snow-white hairs.

Salix Alaxensis, Coville, *Proc. Washington Acad. Sci.* ii. 280 (1900); iii. 311, t. 34; *Bull. N. Y. Bot. Gard.* ii. 164. — Eastwood, *Bot. Gazette*, xxxiii. 133.

Salix speciosa, Hooker & Arnott, *Bot. Voy. Beechey*, 130 (not Host) (1832). — Hooker, *Fl. Bor.-Am.* ii. 145. — Ledebour, *Fl. Ross.* iii. 625. — Seemann, *Bot. Voy. Herald*, 40, t. 10. — Andersson, *Öfvers. Vetensk. Akad. Förhandl.* xv. 119 (*Bidr. Nordam. Pilarter*); *Proc. Am. Acad.* iv. 59. — Rothrock, *Smithsonian Rep.* 1864, 454 (*Fl. Alaska*).

Salix speciosa, *β* **Alaxensis**, Andersson, *De Candolle Prodr.* xvi. pt. ii. 275 (1868).

Salix longistylis, Rydberg, *Bull. N. Y. Bot. Gard.* ii. 163 (1901).

A tree, sometimes thirty feet in height, with a trunk from four to six inches in diameter, often shrubby and in the most exposed situations often not more than a foot or two high, with semiprostrate stems.[1] The branchlets are stout, and when they first appear are coated with a thick covering of white matted hairs; this gradually disappears and in their second season they are usually glabrous, dark purple, lustrous, marked by large elevated pale scattered lenticels, and much roughened by the large U-shaped scars left by the fallen petioles. The leaves are revolute in the bud, elliptical-lanceolate to obovate, acute or occasionally rounded at the apex, and gradually narrowed below into the short thick petioles; when they unfold they are often glandular on the margins, coated above with thin pale deciduous tomentum, and covered below with a thick mass of snow-white lustrous matted hairs which remains on the mature leaves; they are firm in texture, entire and sometimes slightly revolute on the margins, often somewhat wrinkled by the reticulate veinlets, dull yellow-green on the upper surface, from two to four inches long and from an inch to an inch and a half wide, with low broad yellow midribs and many obscure primary veins. The stipules are linear-lanceolate to filiform, entire, from one half to three quarters of an inch in length, and usually persistent at least until midsummer. The flowers appear about the middle of June when the leaves are nearly half grown, and are produced on lateral branchlets whose leaves are well developed or often reduced to small hairy bracts; they are borne in stout erect pedunculate tomentose aments, those of the staminate plant varying from an inch to an inch and a half in length and being much shorter than those of the pistillate plant which at maturity are sometimes five inches long; their scales are oblong-ovate, rounded at the apex, dark-colored, and coated with long silvery white soft hairs. The stamens are two in number, with slender elongated filaments. The ovary is ovate, acuminate, very short-stalked, covered with soft pale hairs, and gradually narrowed into the elongated slender style, crowned by the two-lobed stigmas. The capsule is nearly sessile, ovate, acuminate, covered with close dense pale tomentum, and a quarter of an inch in length.

Salix Alaxensis inhabits Alaska, where it is distributed along the coast from the northern part of the Alexander Archipelago to Cape Lisbourne, and in the interior to the valley of the Mackenzie River and to the shores of Coronation Gulf.[2] It has not been found on the wind-swept Aleutian Islands, but as far north as the eastern end of Kotzebue Sound it is said to sometimes grow to the

[1] The botanists of the Harriman Alaskan Expedition of 1899 found *Salix Alaxensis* growing as an almost prostrate shrub on naked gravels at the Muir Glacier in Glacier Bay, while in the same region and only a few miles distant on older gravel deposits covered with a growth of shrubs it had grown into a handsome small tree. (See Coville, *Proc. Washington Acad. Sci.* ii. 281.)

[2] See Richardson, *Arctic Searching Exped.* ii. 313.

height of twenty feet, while at Cape Lisbourne it is a shrub not more than two feet tall.[1] It attains its largest size from the Shumagin Islands eastward; and it is the only arborescent Willow in the coast region west and north of Kadiak Island.[2]

The wood of *Salix Alaxensis* has not been examined. It is often used as fuel by Indians and travelers on the headwaters of the Arctic rivers.[3]

Salix Alaxensis, which is one of the most beautiful and distinct of the American Willows, was discovered on the shores of Kotzebue Sound during the summer of 1827 by the naturalists who accompanied Captain F. W. Beechey in the British ship Blossom on his voyage of discovery.

[1] See Seemann, *Bot. Voy. Herald*, 40.

[2] Dr. Frederick V. Coville, one of the botanists who accompanied the Harriman Alaskan Expedition of 1899, obtained for the first time reliable information on the distribution of this Willow on the Alaskan coast, and established the fact that under favorable conditions it becomes truly arborescent in habit. (See Coville, *Proc. Washington Acad. Sci.* ii. 280.) Plate dccxxix. is made from drawings of specimens collected by Dr. Coville and preserved in the United States National Herbarium at Washington.

[3] *Teste* Coville, *l. c.* iii. 313.

EXPLANATION OF THE PLATE.

PLATE DCCXXIX. SALIX ALAXENSIS.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower with its scale, enlarged.
3. A flowering branch of the pistillate tree, natural size.
4. A pistillate flower with its scale, enlarged.
5. A fruiting branch, natural size.
6. A capsule, enlarged.
7. A capsule with open valves, enlarged.
8. A leafy branch, natural size.

C.E. Faxon del.

Lartaud sc.

SALIX ALAXENSIS, Cov.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

SALIX AMPLIFOLIA.

Willow.

LEAVES oval to broadly obovate, nearly glabrous at maturity, glaucous on the lower surface.

Salix amplifolia, Coville, *Proc. Washington Acad. Sci.* ii. 282, t. 15 (1900); iii. 314, t. 35.

A tree, occasionally twenty-five feet in height, with a trunk a foot in diameter, often much smaller and sometimes shrubby. The branchlets are stout, conspicuously roughened by the large elevated U-shaped scars of fallen leaves, and marked by occasional pale lenticels; when they first appear they are coated with thick villose pubescence which gradually disappears during their second and third seasons when the bark is of a dark dull red-purple color. The leaves are revolute in vernation, oval to broadly obovate, rounded or broadly acute at the apex, gradually or abruptly narrowed at the cuneate base, dentate-serrulate, particularly toward the base, or entire, densely villose above and below, with long matted white hairs, when they first appear, and at maturity glabrous or nearly glabrous, pale yellow-green on the upper surface, slightly glaucous on the lower surface, from two inches to two inches and a half in length and from an inch to an inch and a half in width, with short slender tomentose petioles, midribs broad and hoary toward the base of the leaf and thin and glabrous above the middle, and numerous thin arcuate primary veins. The stipules have not been seen. The flowers, which appear with the leaves from the middle to the twentieth of June, are produced on lateral leafy branchlets; they are borne in stout pedunculate tomentose aments, those of the staminate plant varying from an inch and a half to two inches in length, and shorter than those of the pistillate plant which at maturity are about three inches long; their scales are oblanceolate or lanceolate, dark brown or nearly black, and covered with long pale hairs. The stamens are two in number, with slender elongated glabrous filaments. The ovary is ovate-lanceolate, short-stalked, glabrous or slightly pubescent, and gradually narrowed into the elongated slender style crowned with a two-lobed slender stigma. The capsule is ovoid-lanceolate, glabrous, short-stalked, and about a quarter of an inch in length.

Salix amplifolia inhabits the sand dunes which for a few miles skirt the beach on the west side of Yakutat Bay, Alaska, at the mouth of streams flowing from the glaciers of the St. Elias Mountain range, where it grows with *Salix Alaxensis*, and where it was discovered by Dr. F. V. Coville[1] on June 22, 1899. It was also collected by Dr. Coville in Disenchantment Bay at Hubbard Glacier and on Haenke Island and Egg Island, and on the east shore at the head of Yakutat Bay.

The wood of *Salix amplifolia* has not been examined.

[1] Frederick Vernon Coville (March 23, 1867) was born on a farm in the township of Preston, Chenango County, New York, of a family of English and Scotch descent. In 1869, his father having moved to Oxford, New York, the son was educated in the academy of that town until his entrance at Cornell University, from which he was graduated in 1887. In the summer of that year Coville joined the Geological Survey of Arkansas as a volunteer assistant, devoting his time to the study of the flora of the central and northern parts of that state. He was then instructor in botany at Cornell for one year, and in July, 1888, was appointed assistant botanist in the United States Department of Agriculture. In 1893, on the death of Dr. George Vasey, he was placed in charge of the division of botany of that department. Mr. Coville was botanist of the United States Death Valley Expedition of 1891, and his important report, which greatly increased the knowledge of the flora of southeastern California, forms the fourth volume of the *Contributions from the United States National Herbarium*; in 1899 he was one of the botanists who accompanied the Harriman Alaskan Expedition. He is the author of several botanical and biographical papers published in the *Proceedings of the Biological Society of Washington*, in the Reports of the Department of Agriculture, and in the *Proceedings of the Washington Academy of Science*. In the last he has described in two papers the Willows of Alaska.

EXPLANATION OF THE PLATE.

PLATE DCCXXX. SALIX AMPLIFOLIA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower with its scale, enlarged.
3. A flowering branch of the pistillate tree, natural size.
4. A pistillate flower with its scale, enlarged.
5. A fruiting branch, natural size.
6. A capsule, enlarged.

C.E.Faxon del. Rapine sc.

SALIX AMPLIFOLIA, Cov.

A.Riocreux direx.t Imp. J. Taneur, Paris.

POPULUS ACUMINATA.

Cottonwood.

LEAVES rhomboid-lanceolate, long-acuminate, green on both surfaces; petioles slender, nearly terete.

Populus acuminata, Rydberg, *Bull. Torrey Bot. Club*, xx. 46, t. 149 (1893); *Contrib. U. S. Nat. Herb.* iii. 523. — Sargent, *Silva N. Am.* ix. 172. — Britton & Brown, *Ill. Fl.* i. 491, f. 1167. — Britton, *Man.* 309.

A tree, sometimes fifty or sixty feet tall, with a trunk three feet in diameter, but usually not more than forty feet in height, with a trunk from twelve to eighteen inches in diameter,[1] and stout spreading and ascending branches which form a compact round-topped or pyramidal head. The bark of young stems and of the large branches is smooth and nearly white, and on old trunks it is pale gray-brown, about half an inch thick and deeply divided into broad flat ridges. The branchlets are slender, terete or slightly four-angled, pale yellow-brown, and roughened for two or three years by the elevated oval horizontal leaf-scars which contain three dark fibro-vascular bundle-scars. The winter-buds are resinous, acuminate, and about a third of an inch in length, with six or seven light chestnut-brown lustrous scales, the lateral buds being much flattened by pressure against the branch. The leaves, which are pendulous on slender nearly terete petioles from one to three inches in length, are rhomboid-lanceolate, abruptly acuminate, gradually or abruptly narrowed and cuneate or concave-cuneate or rarely full and rounded at the mostly entire base, coarsely crenulate-serrate except near the apex, thick and leathery at maturity, dark green and lustrous on the upper surface, dull green on the lower surface, from two to four inches long and from three quarters of an inch to two inches wide, with slender yellow midribs, thin remote primary veins and obscure reticulate veinlets. The stipules are ovate, acute and apiculate or acuminate at the apex, about an eighth of an inch long, and caducous. The aments of flowers, which appear before the leaves, are slender, short-stalked, and from two to three inches in length, with scarious light brown glabrous scales dilated and irregularly divided at the apex into filiform lobes, and caducous. The numerous stamens, with short filaments and dark red anthers, are inserted on a wide oblique membranaceous disk. The ovary is broadly ovate, gradually narrowed to the apex, which is crowned with large laciniately lobed nearly sessile stigmas and inclosed nearly to the middle in the deep cup-shaped disk which is persistent under the fruit. The fruiting aments are four or five inches long and the capsules are pedicellate, oblong-ovate, acute, thin-walled, slightly pitted, about a third of an inch long, and three or occasionally two-valved. The seeds are oblong-obovate, rounded at the apex, light brown, about one twelfth of an inch in length, and surrounded by long white hairs.

Populus acuminata inhabits the banks of streams in the arid eastern foothill region of the Rocky Mountains and, although probably nowhere common, is distributed from Assiniboia[2] to western Nebraska,[3] eastern Wyoming,[4] and southern Colorado. Long confounded with *Populus angustifolia*, it was first distinguished by Mr. P. A. Rydberg,[5] who found in 1891 a number of trees of this Cottonwood in Carter Cañon in Scott's Bluff County, northwestern Nebraska.

[1] The wood specimen cut in northwestern Nebraska for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is twelve and a half inches in diameter inside the bark and only twenty-eight years old. The sapwood is two and three eighths inches thick, with sixteen layers of annual growth.

[2] *Populus acuminata* was collected by Mr. John Macoun at Lethbridge, Assiniboia, June 5, 1894.

[3] Bessey, *Rep. Nebraska State Board Agric.*, 1894, 104; 1899, 85.

[4] See Nelson, *Bull.* No. 40, Wyoming Exper. Stat. 92 (*Trees of Wyoming*).

[5] Per Axel Rydberg (July 7, 1860) was born in Oth Parish, Westergoethland, Sweden, and was the son of a farmer. At the age of thirteen he was sent to the preparatory school of the Royal Gymnasium at Skara, and in 1881 was graduated from the Gymna-

Populus acuminata is sometimes planted to shade the streets of Laramie, Denver, Colorado Springs, and other cities in the region which it inhabits.[1]

sium. He came to America in 1882, and from 1884 to 1890 and again from 1891 to 1893 was a teacher of natural sciences and mathematics at Luther Academy, Wahoo, Nebraska. The years 1890–91 and 1893–95 he spent at the University of Nebraska, receiving from that institution the degrees of Bachelor of Science in 1891 and of Master of Arts in 1895. In 1895 Mr. Rydberg entered Columbia University and three years later obtained the degree of Doctor of Philosophy. From 1895 to 1896, while a student at Columbia University, he performed the duties of Professor of Natural Sciences and Mathematics at the Upsala College in Brooklyn. During the summers of 1891, 1892, and 1893, he was a field agent of botany of the United States Department of Agriculture; in 1895 and 1896 of the Division of Agrostology of that Department, and in 1897 of the New York Botanic Garden, collecting plants in Nebraska, South Dakota, Wyoming, Colorado, Utah, and Montana. Mr. Rydberg is the author of a number of botanical papers and reports, including a *Flora of the Black Hills of South Dakota* and of the *Sand Hills of Central Nebraska*, a paper on the *Grasses and Forage Plants of the Rocky Mountain Region*, with Mr. C. L. Shear, a *Monograph of the North American Species of Physalis and Related Genera*, a *Monograph of the North American Potentillæ*, and a *Catalogue of the Flora of Montana and the Yellowstone National Park.*

[1] The oldest specimen of *Populus acuminata* which I have seen was collected by Dr. F. V. Hayden on Reynolds's expedition to the headwaters of the Missouri and Yellowstone rivers in 1859–60, and is preserved in the Engelmann herbarium. In 1874 it was collected by Engelmann at Denver, Colorado, and in 1880 I found it in the streets of Colorado Springs.

EXPLANATION OF THE PLATE.

PLATE DCCXXXI. POPULUS ACUMINATA.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. The bract of a staminate flower, enlarged.
4. A branch with pistillate flowers, natural size.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. A fruit, enlarged.
8. A leafy branch, natural size.

C.E. Faxon del.

Rapine sc.

POPULUS ACUMINATA, Rydb.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

POPULUS WISLIZENI.

Cottonwood.

PISTILLATE flowers long-pedicellate. Leaves deltoid, abruptly short-pointed, coarsely crenulate-serrate, their petioles laterally compressed.

Populus Wislizeni.

Populus monilifera, Torrey, *Bot. Mex. Bound. Surv.* 204 (not Aiton) (1859).

Populus Fremontii, var. (?) **Wislizeni**, Watson, *Am. Jour. Sci.* ser. 3, xv. 136 (1878); *Proc. Am. Acad.* xviii. 157. — Brewer & Watson, *Bot. Cal.* ii. 92 (in part). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 175 (excl. syn.). — Wesmael, *Bull. Bot. Soc. Belg.* xxvi. 377 (*Rev. Gen. Populus*) (in part). — Coulter, *U. S. Nat. Herb.* ii. 420 (*Man. Pl. W. Texas*).

Populus Fremontii, Sargent, *Silva N. Am.* ix. 183 (in part) (1896).

A large tree, with wide-spreading branches and pale gray-brown bark deeply divided into broad flat ridges, stout light orange-colored glabrous branchlets, and acute lustrous buds. The leaves are broadly deltoid, abruptly short-pointed, truncate or sometimes cordate at the broad entire base, coarsely and irregularly crenulate-serrate except toward the entire apex, coriaceous, glabrous, yellow-green and lustrous on both surfaces, from two inches to two inches and a half long and usually about three inches wide, with slender yellow midribs, thin remote primary veins, and conspicuous reticulate veinlets; they are borne on slender glabrous petioles compressed laterally, from an inch and a half to two inches long, and bright yellow in the autumn before falling. The stipules are broadly ovate, acute and apiculate or acuminate at the apex, scarious, and caducous. The aments appear before the leaves and vary from two to four inches in length, with caducous bracts which are scarious, light red, and divided at the apex into elongated filiform lobes. The numerous stamens with large oblong anthers and short filaments are inserted on a broad oblique disk. The ovary is long-pedicellate, ovate, full and rounded at the apex, crowned by three broad crenulate-lobed stigmas raised on the short branches of the style, and inclosed nearly to the middle in the cup-shaped disk which is irregularly toothed on the margins and persistent under the fruit. The aments of fruit are four or five inches long, with oblong-ovate thick-walled acute three or four-valved slightly ridged buff-colored capsules which are about a quarter of an inch long, and are borne on slender pedicels from one half to three quarters of an inch in length, and placed rather remotely from each other on the slender glabrous rachis.

Populus Wislizeni is the common Cottonwood of the Rio Grande valley in New Mexico and western Texas, and in the adjacent parts of Mexico.[1] From the other Cottonwoods it can be easily distinguished by the elongated slender pedicels of the pistillate aments which are peculiar to this tree and, showing no tendency to become abbreviated, make it desirable to treat it as a species.

Populus Wislizeni was discovered on the upper Rio Grande in July, 1846, by Dr. F. A. Wislizenus.[2]

[1] Specimens of a Cottonwood collected by Miss Alice Eastwood in July, 1895, on Recapture Creek, San Juan County, southeastern Utah, although beyond its usual range, appear to belong to this species (Eastwood, *Proc. Cal. Acad.* ser. 2, vi. 325).

[2] See vi. 94.

EXPLANATION OF THE PLATE.

PLATE DCCXXXII. POPULUS WISLIZENI.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A branch with pistillate flowers, natural size.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.

C.E. Faxon del.

Rapine sc.

POPULUS WISLIZENI, Sarg.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

POPULUS MEXICANA.

Cottonwood.

PISTILLATE flowers short-pedicellate, their disk large and cup-shaped. Leaves rhombic to broadly deltoid, elongated, acute or acuminate, green on both surfaces.

Populus Mexicana, Wesmael, *De Candolle Prodr.* xvi. pt. ii. 328 (1868); *Mém. Soc. Sci. Hainaut*, sér. 3, iii. 240, t. 15 (*Monogr. Populus*). — Hemsley, *Bot. Biol. Am. Cent.* iii. 181.

Populus Fremontii, Watson, *Proc. Am. Acad.* x. 350 (in part) (1875); *Am. Jour. Sci.* ser. 3, xv. 136 (in part). — Brewer & Watson, *Bot. Cal.* ii. 92 (in part). — Rusby, *Bull. Torrey Bot. Club*, ix. 79. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 175 (in part); *Silva N. Am.* ix. 183 (in part). — Wesmael, *Bull. Bot. Soc. Belg.* xxvi. 376 (in part) (*Rev. Gen. Populus*).

A tree, sometimes eighty feet in height, with a trunk three or four feet in diameter covered with pale gray or nearly white bark deeply divided into broad flat ridges and heavy gracefully spreading and ascending branches which form a broad open head. The branchlets are slender, and when they first appear they are pale green and more or less pubescent or villose, with long matted hairs, but soon become glabrous and are light yellow-brown during their first season. The terminal winter-buds are narrow, acute, light orange-brown, puberulous toward the base of the outer scales, about one quarter of an inch long, and two or three times as large as the much compressed oblong lateral buds. The leaves are rhombic and long-pointed, especially when the tree is young, or broadly deltoid and acute or acuminate particularly on vigorous shoots, broadly or acutely cuneate or truncate or slightly cordate at the base, or often rounded at the apex and much broader than long, usually coarsely and irregularly crenulate-serrate except at the base and towards the apex, and finely crenulate-serrate above the middle when the leaves are broad and rounded; when they first unfold the leaves are dark red covered on the lower surface with pale pubescence, puberulous on the upper surface, ciliate on the margins, with short white crowded hairs, and glandular on the tips of the teeth, with bright red caducous glands; soon becoming glabrous, at maturity they are subcoriaceous, bright yellow-green, very lustrous, two or three inches long and somewhat narrower or much broader than long, with slender yellow midribs, obscure primary veins, coarse reticulate veinlets, and slender nearly terete petioles grooved on the upper side near the base, at first puberulous, soon glabrous, and from an inch and a half to nearly two inches in length. The stipules are ovate, acute or acuminate, scarious, villose, from one sixteenth to one eighth of an inch long, and caducous. The flowers appear before the leaves late in February or early in March, the staminate in dense cylindrical aments usually from an inch to an inch and a half in length, the pistillate in slender many-flowered aments from an inch and a half to two inches long. The ovary is ovate, rounded at the apex, slightly three or four-angled, short-pedicellate, and nearly inclosed in the cup-shaped membranaceous disk. The fruiting aments are three or four inches long, and the capsules are borne on short stout pedicels thickly placed on the rachis, and are round-ovoid, buff color, slightly three or four-lobed, deeply pitted, thin-walled, about one third of an inch long, and surrounded at the base by the much enlarged disk.[1]

[1] *Populus Mexicana* is very closely related to the California *Populus Fremontii*, differing chiefly from that species in the larger disk of the pistillate flowers, in the rhombic leaves which are common on young plants, and appear frequently on the same branch with broad deltoid leaves, and in its distribution; and when the Poplars of the southwest are better known than they are now it may be found desirable to treat this north Mexican tree as a variety of the California species.

Populus Mexicana is the common Cottonwood of northern Mexico, and it is this tree which is planted in the streets of Mexican cities. (See Pringle, *Garden and Forest*, i. 105 f.) It is also the common Cottonwood of the valleys of southern Arizona and south-

Populus Mexicana inhabits the banks of mountain streams in southern Arizona and southwestern New Mexico, and is widely distributed through northern Mexico.

Populus Mexicana appears to have been first collected by Berlandier in northern Mexico.

western New Mexico. In eastern New Mexico it appears to be replaced by *Populus Wislizeni* and by the Rocky Mountain form of *Populus deltoidea*, which in the ninth volume of this work was confounded with *Populus Fremontii* so far as relates to Colorado, eastern New Mexico, and western Texas, and which Professor Trelease has called var. *intermedia* in his unpublished notes on the genus Populus.

EXPLANATION OF THE PLATE.

PLATE DCCXXXIII. POPULUS MEXICANA.

1. A flowering branch of a staminate tree, natural size.
2. A staminate flower, enlarged.
3. A flowering branch of a pistillate tree, natural size.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A fruit, enlarged.
7. Leaf of a shoot, natural size.

C.E. Faxon del.

Lartaud sc.

POPULUS MEXICANA, Wesm.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

SERENOA.

Flowers perfect; calyx cupular, unequally 3-lobed; corolla 3-parted, the lobes valvate in æstivation; stamens 6, their filaments triangular, joined at the base; carpels 3, united above into an elongated style; ovule basilar, erect. Fruit drupaceous, 1-seeded. Spadix interfoliar, elongated. Leaves alternate, orbicular or truncate, petiolate, their petioles dentate.

Serenoa, Hooker f. *Bentham & Hooker, Gen.* iii. 926, 1228 (1883). — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 37. — Baillon, *Hist. Pl.* xiii. 314.

Unarmed trees or shrubs, with tall arborescent and often clustered or short or elongated subterranean endogenous stems clothed above for many years with the sheathing bases of the petioles of the fallen leaves, and stout tough deep-descending roots. Leaves terminal, induplicate in vernation, semiorbicular, truncate at the base, coriaceous, green, or pale and glaucous on the lower surface, divided from the apex to below the middle into numerous two-parted segments plicately folded at the base; rachis short, acute; ligule thin, concave, obtusely short-pointed, furnished with a broad membranaceous dark red-brown deciduous border; petioles slender, flat above, rounded and ribbed on the lower surface, dentate on the margins; vaginas thin and firm, bright mahogany red, lustrous, closely infolding the stem, their fibres thin and brittle. Spadix paniculate, interfoliar, elongated, its rachis slender, compressed; branches numerous, slender, elongated, gracefully drooping, coated with hoary tomentum, the primary panicled at the base and simple toward the apex of the spadix, flattened, the secondary terete from the axils of ovate acute chestnut brown bracts; spathes flattened, thick and firm, deeply two-cleft and furnished at the apex with a broad or narrow red-brown membranaceous border, inclosing the rachis of the panicle, each primary branch with its spathe and the node of the rachis below it inclosed in a separate spathe, the whole surrounded by the larger spathe of the node next below. Flowers perfect, small or minute, sessile on the ultimate branches of the spadix in the axils of ovate acute chestnut-brown bracts, solitary toward the ends of the branchlets, and in two or three-flowered clusters toward their base, bibracteolate, the bractlets minute, caducous. Calyx truncate at the base, unequally three-lobed, the lobes valvate in æstivation, thickened and persistent under the fruit. Corolla three-parted nearly to the base, its divisions valvate in æstivation, oblong-ovate, thick, concave, acute and thickened at the apex, grooved on the inner surface with two or three deep depressions, deciduous. Stamens six, included; filaments nearly triangular, united below into a cup adnate to the short tube of the corolla; anthers short-oblong, attached on the back below the middle, introrse, two-celled, the cells opening longitudinally; ovary oblong-obovate, of three carpels free below, united above into a slender elongated style; stigma minute, terminal on the fruit; ovule solitary, erect from the bottom of the cell, anatropous. Fruit drupaceous, oblong-ovoid or globose, one-seeded, black, and lustrous, usually bearing at the base the two minute abortive carpels; exocarp thin and fleshy; mesocarp thin and fibrous, orange-brown, resinous and strong-smelling, closely investing the pale brown crustaceous putamen. Seed erect, free, oblong, or subglobose; testa hard, chestnut-brown, and lustrous, lighter colored on the ventral side with a conspicuous oblong or circular mark; hilum small, subbasilar; raphe ventral, elongated, undivided; albumen homogeneous. Embryo lateral.

Serenoa with two species is confined to the coast region of the south Atlantic and Gulf region of

North America. One species[1] is a slender tree found only in the swamps and low hummocks adjacent to the Chockoliskee River in southwestern Florida, and the other, which is the type of the genus, is a low plant generally scattered over sandy barrens from South Carolina to Louisiana, often covering great areas almost to the exclusion of other plants.

Serenoa is not known to suffer from the attacks of insects or serious fungal diseases.[2]

The generic name commemorates the distinguished botanical services of Sereno Watson.[3]

[1] *Serenoa serrulata*, Hooker f. *Bentham & Hooker Gen.* iii. 926 (1888). — Langlois, *Cat. Pl. Basse-Louisiane*, 17. — Chapman, *Fl.* ed. 3, 462. — Mohr, *Contrib. U. S. Nat. Herb.* vi. 424 (*Plant Life of Alabama*).

Chamærops serrulata, Michaux, *Fl. Bor.-Am.* i. 206 (1803). — Willdenow, *Spec.* iv. pt. ii. 1155. — Aiton, *Hort. Kew.* ed. 2, v. 489. — Pursh, *Fl. Am. Sept.* i. 239. — Nuttall, *Gen.* i. 231. — Elliott, *Sk.* i. 431. — Sprengel, *Syst.* ii. 137. — Loudon, *Arb. Brit.* iv. 2532.

Sabal serrulata, Roemer & Schultes, *Syst.* vii. pt. ii. 1486 (1830). — Dietrich, *Syn.* ii. 1201. — Kunth, *Enum.* iii. 246. — Chapman, *Fl.* 438.

Brahea serrulata, H. Wendland, *Kerchove Les Palmiers*, 235 (1878).

Serenoa serrulata, the Saw-Palmetto, produces a horizontal stem which is sometimes six or eight inches in diameter, and frequently extends for ten or twelve feet at a distance of from two to four feet below the surface of the ground. From this stem, which under specially favorable conditions occasionally rises to the height of a few feet above the ground, numerous stout roots penetrate deep into the soil, and short secondary stems rise to the surface and bear heads of numerous leaves which are supported on slender rigid petioles, and are thick and firm, about a foot in diameter, and pale on the lower surface, especially while young. From April to June it produces irregularly its flowers in ample panicles, remarkable for the long thin membranaceous red-brown boat-shaped tips of the spathes; and in the autumn the oblong-ovoid fruit, which is often an inch in length, covers the now drooping panicles, and affords abundant food for birds and many animals.

The fruit of *Serenoa serrulata* possesses remarkable fattening properties, and the domestic animals which feed on it soon become sleek and fat. In medicine it has been found sedative, nutrient, and diuretic, and about two hundred and fifty tons of Saw-Palmetto berries are now consumed in the United States in the manufacture of fluid extracts used to improve digestion, increase weight and strength, to induce sleep, to relieve irritation of the mucous membrane of the throat, nose, and larynx, and to strengthen enfeebled sexual organs, and in the treatment of the enlarged prostate gland. (See Dupore, *Medical Brief*, 1877, 123. — Goss, *Therapeutic Gazette*, n. ser. i. 243. — Parke, Davis & Co., *Organic Mat. Med.* ed. 2, 159; *Pharmacology of the Newer Mat. Med.* No. 52, 1141 [*Therapeutic Properties of Saw Palmetto*]. — Rusby, Bastedo & Coblentz, *Alumni Jour. N. Y. College of Pharmacy*, ii. 169 [*The Pharmacology of Saw Palmetto*].)

The stem of *Serenoa serrulata* contains tannin in considerable quantities, and excellent leather has been prepared from it, although the large amount of red coloring matter associated with the tannin has a tendency to make a dark leather, and the manufacture of "syrup of tannin," an extract made from *Serenoa serrulata* and sold a few years ago in northern markets, has been abandoned. (See Trimble, *Garden and Forest*, ix. 182 [*The Tannins of the Palmettos*]; *Am. Jour. Pharm.* lxviii. 397.) The flowers produce a large amount of nectar, which is an important bee-food, and the superior honey made from them is sold as Palmetto honey. (See Rusby, Bastedo & Coblentz, *l. c.* 171.) The collection and shipment to the northern states of the crowns of fresh leaves of the Saw-Palmetto for the decoration of churches and dwelling-houses has recently become a Florida industry of some importance.

[2] Most of the fungi which have been recorded as occurring on Serenoa are found on the petioles of the leaves. Of the seventeen species recorded some are found also on *Sabal Palmetto*. They are all small, and do not cause disease. *Meliola palmicola*, Winter, infests the leaves, covering them with a sooty black web.

[3] See vii. 108.

SERENOA ARBORESCENS.

FRUIT globose. Leaves green on both surfaces.

Serenoa arborescens, Sargent, *Bot. Gazette*, xxvii. 90 (1899).

A tree, from thirty to forty feet in height, with one or several clustered erect inclining or occasionally semiprostrate stems three or four inches in diameter, and covered almost to the ground with the closely clasping bases of the leaf-stalks and below with a thick pale gray rind. The leaves are thin and firm, bright yellow-green on the upper surface, blue-green on the lower surface, about two feet in diameter, and divided nearly to the base into numerous lobes which are half an inch wide near the middle of the leaf and are only slightly thickened at the pale yellow midribs and margins; their petioles, at first erect, soon become spreading and are from eighteen inches to two feet in length, one third of an inch wide at the apex and an inch wide at the base, and are armed with stout flattened curved orange-colored teeth. The spadix is from three to four feet long, with a slender much flattened stalk, panicled lower branches eighteen or twenty inches in length, and six or eight thick firm pale green conspicuously ribbed spathes deeply divided at the apex, which terminates in a narrow membranaceous border. The flowers, which are about one twentieth of an inch long, are solitary toward the ends of the branches and in two or three-flowered clusters at their base; their calyx is light chestnut-brown and the corolla is pale yellow-green. The fruit is globose and a third of an inch in diameter, with thin dry flesh covering the dark orange-colored fibrous strong-smelling resinous inner coat which closely invests the pale brown crustaceous nut. The seed is subglobose, somewhat flattened below, with a pale vertical mark on the lower side, a minute hilum joined to the micropyle by a pale band, and an obscure oblong acute raphe.

Serenoa arborescens inhabits the great Cypress swamps and low hummocks adjacent to the Chockoliskee River and its tributaries in southwestern Florida which, south of Cape Romano, extend from the neighborhood of the coast to the borders of the Everglades. Growing always in low undrained soil, it stands for many months of every year in water from one to eighteen inches deep. Occasionally occupying almost exclusively areas several acres in extent, it is more often scattered among Cypress-trees or southward among Royal Palms.

Serenoa arborescens was discovered[1] in the spring of 1887 in the Royal Palm Hummock near the town of Everglade on the Chockoliskee River by Mr. Pliny W. Reasoner.[2]

[1] At the time of its discovery neither flowers nor fruit were collected, but in October, 1888, Mr. E. N. Reasoner visited the Chockoliskee River and obtained a few seeds, a stem for the Jesup Collection of North American Woods in the American Museum of Natural History, New York, and a few small plants. One of these has been grown in my garden in Brookline, Massachusetts, and is now about eight feet high. In the spring of 1898 Dr. Robert Ridgway, the distinguished ornithologist, informed me that his guide on a recent journey which he had made to the southeast of Fort Myers on the Caloosahatchee River, Mr. R. G. Corbett of Immockalee, had told him of a tall slender Palm in the Cypress swamps thirty or forty miles to the southeast of Lake Trafford and near the head of the Chockoliskee; and through Mr. Corbett I obtained in 1898 leaves, flowers, and ripe fruits of this interesting Palm, which proved identical with the one discovered by Mr. Reasoner, and a second species of Serenoa.

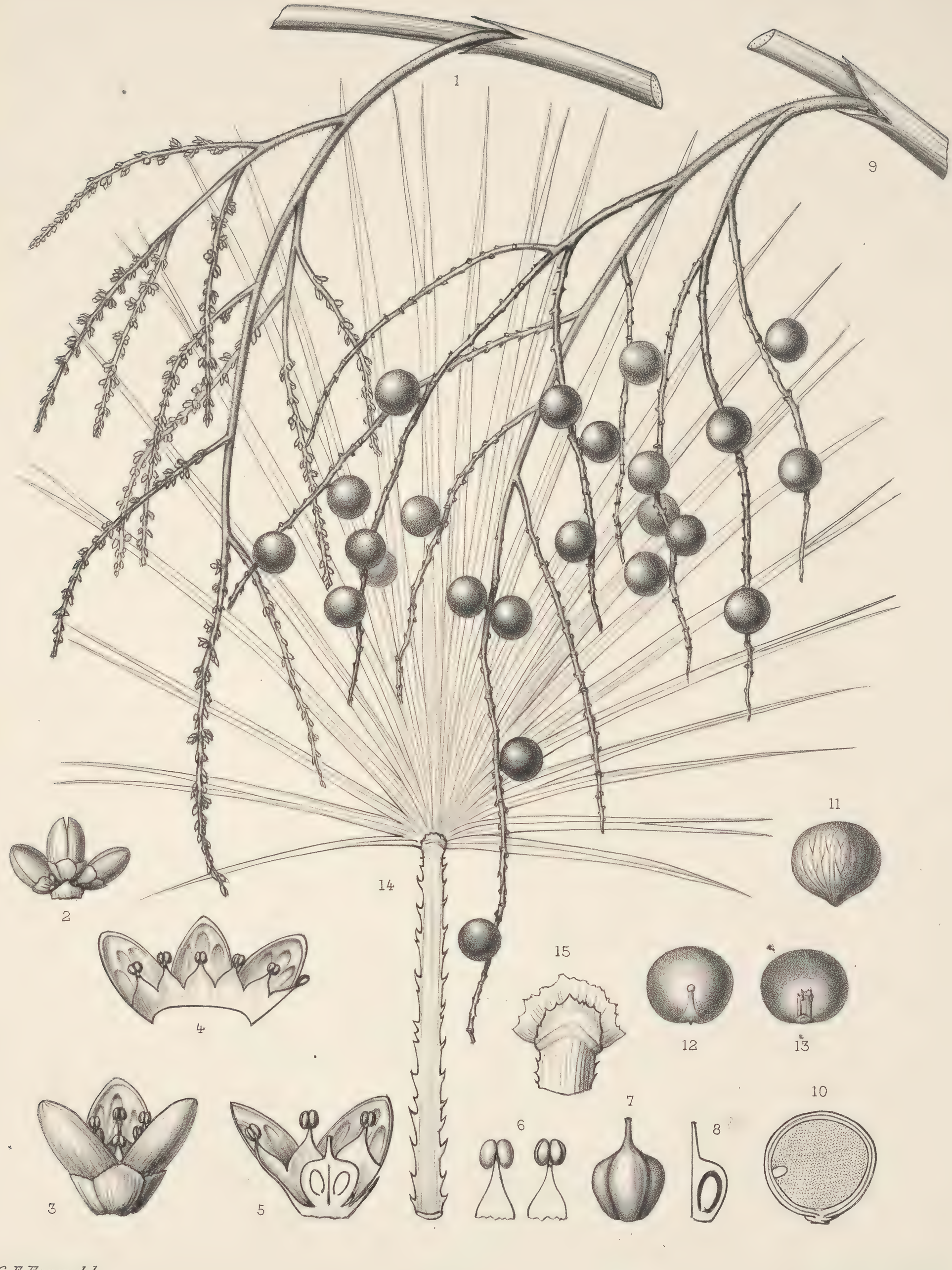
[2] Pliny Ward Reasoner (May 6, 1863–September 17, 1888) was born in Princeton, Illinois, and was the son of Henry C. Reasoner, who moved in 1848 from South Egremont, Massachusetts, to Illinois, where he married and engaged in farming. Young Reasoner was educated in the high school at Princeton, and in 1881 went to Florida, where he established at Oneco near the Manitee River a commercial nursery in which he gathered together a large collection of tropical and subtropical plants and where he died of yellow fever just when his intelligence, industry, and energy had made him widely and favorably known and the usefulness and success of his career seemed assured.

Mr. Reasoner was a constant contributor to the horticultural journals of the country, writing principally on exotic plants suitable for cultivation in southern Florida, and he was the author of a report on *Tropical and Semitropical Fruits in Florida and the Gulf States*, published in 1887 by the Department of Agriculture of the United States in *Bulletin* No. 1, *Division of Pomology*.

EXPLANATION OF THE PLATE.

PLATE DCCXXXIV. SERENOA ARBORESCENS.

1. Portion of a flowering spadix, natural size.
2. A cluster of flowers, enlarged.
3. A flower, enlarged.
4. A flower laid open, showing petals and stamens, enlarged.
5. Vertical section of a flower, enlarged.
6. An anther, rear and front views, enlarged.
7. A pistil, enlarged.
8. Vertical section of a carpel, enlarged.
9. Portion of a fruiting spadix, natural size.
10. Vertical section of a fruit, enlarged.
11. A fruit, the pericarp removed, showing the fibrous mesocarp, enlarged.
12. A seed, enlarged.
13. A seed, showing the hilum, enlarged.
14. A leaf, much reduced.
15. A ligule with its membranaceous border, enlarged.



C.E.Faxon del.

Em.Himely sc.

SERENOA ARBORESCENS, Sarg.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

THRINAX.

FLOWERS perfect; calyx and corolla confluent into a short cup, 6-lobed on the margin; stamens usually 6; ovary 1-celled; ovule basalar, erect. Fruit drupaceous, globose, ivory-white; exocarp fleshy; putamen crustaceous. Spadix interfoliar, elongated, paniculate. Leaves orbicular, or truncate at the base, petiolate, their petioles unarmed.

Thrinax, Swartz, *Prodr.* 57 (1788). — Schreber, *Gen.* 772. — Martius, *Palm. Fam. Gen.* 8. — Endlicher, *Gen.* 253. — Meisner, *Gen.* 357. — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 34 (sect. *Porothrinax*). — Sargent, *Silva N. Am.* x. 49 (sect. *Porothrinax*); *Bot. Gazette*, xxvii. 83.

Small unarmed trees, with simple endogenous stems marked below with the ring-like scars of fallen leaves and clothed above with the long-persistent sheaths of the leaf-stalks, and long tough wiry roots covered with thick orange-brown loosely attached rind. Leaves terminal, induplicate in vernation, alternate, orbicular, or truncate at the base, thick and firm, usually silvery white on the lower surface, more or less deeply divided into narrow acute two-parted obliquely folded lobes, with thickened margins and midribs; rachis reduced to a narrow border, with a thin usually undulate reflexed margin; ligule thick, concave, pointed, often lined while young with hoary tomentum; petioles stout, elongated, flattened, rounded above and below, their margins thin and smooth, concave toward the base, and gradually enlarged into vaginas composed of coarse netted fibres covered with thick hoary tomentum. Spadix paniculate, interfoliar, pedunculate, elongated, its primary branches short, alternate, flattened, incurved, furnished with numerous slender terete alternate pendant secondary flower-bearing branchlets produced in the axils of ovate acute scarious deciduous bracts; spathes numerous, tubular, coriaceous, two-cleft, and more or less tomentose toward the apex, each primary branch of the panicle with its spathe and the node of the rachis below it included in a separate spathe, the whole surrounded by the larger spathe of the node next below. Flowers solitary, minute, articulate on elongated, or short thick disk-like pedicels in the axils of ovate acute deciduous bracts. Perianth truncate at the base, six-lobed, the lobes obscure or broadly ovate and acute, persistent under the fruit. Stamens six or nine,[1] inserted on the base of the perianth; filaments subulate, thickened and scarcely united at the base, or nearly triangular and united below into a cup adnate to the perianth; anthers oblong, two-celled, opening longitudinally, inserted on the back below the middle, introrse, becoming reflexed and extrorse at maturity. Ovary superior, ovoid, one-celled, gradually narrowed into a stout columnar style crowned by a broad funnel-formed flat or oblique stigma; ovule solitary, basalar, erect, semianatropous; micropyle lateral. Fruit drupaceous, globose, marked at the apex by the remnants of the style and bearing at the base the slightly thickened perianth of the flower; sarcocarp thin, green, crustaceous, ultimately becoming thickened, ivory-white, juicy, bitter, easily separable from the thin putamen of two closely adherent coats, the outer crustaceous, pale tawny brown and slightly tuberculate, the inner membranaceous, silvery white, and lustrous. Seed free, erect, nearly globose, slightly flattened at the two ends, depressed at the base; hilum subbasilar, oblong, pale, conspicuous; raphe short, unbranched, inconspicuous; testa thin, pale or dark chestnut-brown, and lustrous; albumen uniform, more or less deeply penetrated by a broad basal cavity. Embryo lateral.

[1] In all the Florida species of Thrinax and in *Thrinax parviflora*, Swartz (*Fl. Ind. Occ.* i. 614, t. 13 [1797]), the type of the genus, the number of stamens is six, but in *Thrinax excelsa*, Grisebach (*Fl. Brit. W. Ind.* 515 [1864]. — Hooker f. *Bot. Mag.* cxv. t. 7088) of Jamaica the number is said to be nine.

Thrinax is confined to the New World. Three species inhabit southern Florida;[1] and five or six species, still imperfectly known, are scattered through the Antilles and on the shores of Central America.[2]

The wood of the Florida species of Thrinax is light and soft, and contains numerous small fibro-vascular bundles, the exterior of the stem being much harder than the spongy interior. The stems are used for the piles of small wharves and for turtle crawls, and the leaves are employed as thatch and are manufactured into hats and baskets, and coarse ropes.

The generic name from θρῖναξ is in allusion to the form of the leaves.

[1] For the third Florida species, *Thrinax microcarpa*, see x. 53, t. 511, where the fruit is described as orange-brown in color with a crustaceous pericarp, the true characters of the fully ripe fruit being then unknown to me (see Sargent, *Bot. Gazette*, xxvii. 87).

[2] See Roemer & Schultes, *Syst.* vii. pt. ii. 1300. — Martius, *Nat. Hist. Palm.* iii. 254. — Grisebach, *Fl. W. Ind.* 515; *Cat. Pl. Cub.* 221.

SYNOPSIS OF THE NORTH AMERICAN SPECIES.

Flowers long-pedicellate; perianth obscurely lobed or nearly truncate; filaments subulate, hardly united at the base; stigma oblique . . . . . 1. T. Floridana.

Flowers short-pedicellate; perianth lobes broadly ovate, acute; filaments nearly triangular, united below into a cup adnate to the perianth; stigma flat.

Seeds three sixteenths of an inch in diameter, pale chestnut-brown; leaves from three to four feet in diameter . . . . . 2. T. Keyensis.

Seeds from one sixteenth to one eighth of an inch in diameter, dark chestnut-brown; leaves two feet in diameter or less . . . . . 3. T. microcarpa.

THRINAX FLORIDANA.

Thatch.

FLOWERS long-pedicellate; perianth obscurely lobed or nearly truncate; filaments subulate, hardly united at the base; stigma oblique.

Thrinax Floridana, Sargent, *Bot. Gazette*, xxvii. 84 (1899).

Thrinax parviflora, Vasey, *Rep. U. S. Dept. Agric.* 1875, 186 (*Cat. Forest Trees U. S.*) (not Swartz) (1876). — Chapman, *Bot. Gazette*, iii. 12; *Fl.* ed. 2, Suppl. 651; ed. 3, 462. — Sargent, *Silva N. Am.* x. 51 (in part), t. 510 as to the leaf.

A tree, with a slightly tapering stem, from twenty to thirty feet in height and from four to six inches in diameter, covered with a smooth pale blue-gray rind and generally clothed to the middle and occasionally almost to the ground with the long-persistent clasping bases of the leaf-stalks. The leaves are thick and firm, nearly orbicular, or truncate at the base, from two and a half to three feet in diameter, rather longer than they are broad, yellow-green and lustrous on the upper surface, silvery white on the lower surface, and divided to below the middle into numerous lobes which vary from an inch to an inch and a half in width near the middle of the leaf; the rachis of the leaf is a narrow reflexed undulate orange-colored border and the ligule is long-pointed, bright orange-colored, and three quarters of an inch long and broad; the petioles vary from four feet to four feet and a half in length and are pale yellow-green or orange-colored toward the apex, which is three quarters of an inch wide and coated at first with hoary deciduous tomentum, and much thickened and tomentose and from two inches to two inches and a half wide at the base. The flower-panicles, which in all the Florida species of Thrinax appear two or three months before the flowers open and lengthen very slowly, are when fully grown from three feet to three feet and a half in length, with primary branches from six to eight inches long and secondary branches from an inch and a half to two inches in length; these are ivory-white at the time the flowers open, turning light yellow-green before the fruit ripens, and orange-brown in drying. The flowers are raised on slender pedicels nearly an eighth of an inch long and are ivory-white and very fragrant, with a pungent aromatic odor; their perianth is almost truncate or obscurely six-lobed; the filaments of the six much exserted stamens are subulate and barely united at the base, and the stigma is very oblique; they open in June and sometimes also irregularly in October and November, and the fruit ripens six months later. The fruit is from one quarter to three eighths of an inch in diameter, somewhat depressed above and below, with ivory-white and lustrous juicy bitter flesh, and the seed, which varies from one eighth to nearly one quarter of an inch in diameter, is dark chestnut-brown and penetrated almost to the apex by the broad basal cavity.[1]

In Florida *Thrinax Floridana* inhabits dry coral ridges and sandy shores, and is distributed from Long Key to Torch Key and the islands in its neighborhood, and on the mainland ranges from Cape Romano to Cape Sable.

Thrinax Floridana was discovered by Dr. A. W. Chapman,[2] who found it near Cape Romano in the autumn of 1875, and in October, 1879, it was found by Dr. A. P. Garber[3] on Cape Sable. It is now cultivated in gardens at Miami, Florida.[4]

[1] It is the leaf of this species which was figured on the plate of *Thrinax parviflora* in the tenth volume of this work (t. 510).

[2] See vii. 110.

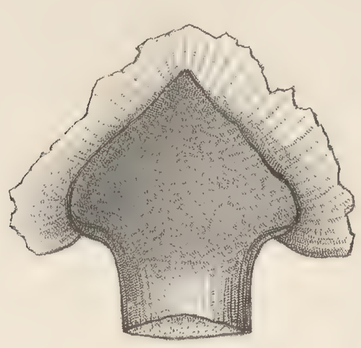
[3] See i. 65.

[4] A number of trees of this Palm brought from Long Key are now established in the garden of the hotel at Miami; and from flowers and fruits gathered from them Mr. Faxon has made the plate of this species. It is the *Thrinax excelsa* of some Florida nurserymen, but not of Grisebach.

EXPLANATION OF THE PLATE.

PLATE DCCXXXV. THRINAX FLORIDANA.

1. Portion of a flowering spadix, natural size.
2. A flower, enlarged.
3. Perianth of a flower with its stamens, laid open, enlarged.
4. A stamen, enlarged.
5. A pistil, enlarged.
6. Portion of a fruiting spadix, natural size.
7. Vertical section of a fruit, enlarged.
8. A seed, enlarged.
9. A leaf, much reduced.
10. A ligule, natural size.



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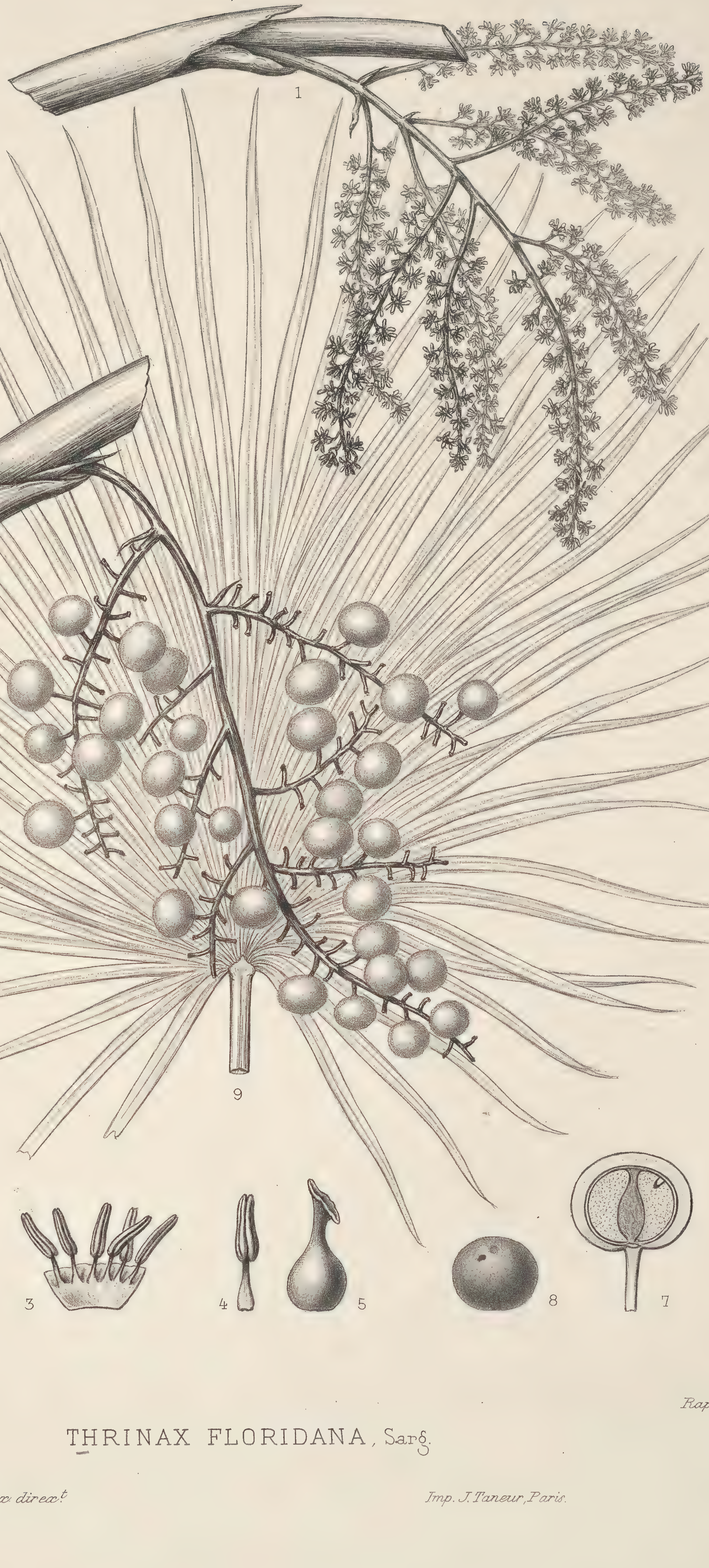

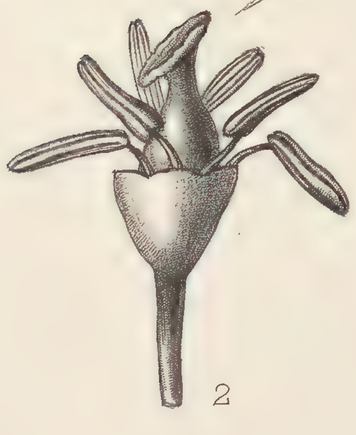

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C.E. Faxon del. *Rapine sc.*

THRINAX FLORIDANA, Sarg.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

THRINAX KEYENSIS.

FLOWERS short-pedicellate; perianth-lobes broadly ovate, acute; filaments nearly triangular, united below; stigma flat. Seeds pale chestnut-brown.

Thrinax Keyensis, Sargent, *Bot. Gazette*, xxvii. 86 (1899).

A tree, with an ashy gray stem, often twenty-five feet in height and from ten to fourteen inches in diameter, raised on a base of thick matted roots from two to three feet high and eighteen or twenty inches wide, and surmounted by a broad head of leaves, the upper erect, the lower, both living and dead, pendulous and closely pressed against the stem. The leaves are nearly orbicular, or truncate at the base, but rather longer than they are broad, from three to four feet long, and divided for two thirds of their length into lobes which are often two and a half inches wide near the middle of the leaf, the lowest lobes being parallel with the petiole or spreading from it nearly at right angles; they are thick and firm, light yellow-green and very lustrous on the upper surface, with bright orange-colored midribs and much thickened orange-colored margins to the lobes, and on the lower surface they are coated when they unfold with hoary deciduous tomentum and at maturity are pale blue-green and more or less covered with loosely attached silvery white pubescence; the rachis of the leaf is a thin undulate border and the ligule is thick, pointed, an inch in length and in width, and lined at first with hoary tomentum; the leaves are borne on stout petioles flattened above, obscurely ridged on the lower surface, tomentose while young, pale blue-green, from three to four feet long, an inch wide at the apex and from three to four inches wide at the much thickened concave base, which is coated with a thick silvery white felt-like tomentum which also covers the broad vaginas composed of thick loosely woven coarse tough fibres. The flower-panicles are usually about six feet in length and are stout, spreading, and gracefully incurved, with firm thick spathes more or less coated with hoary tomentum; their primary branches are much compressed and vary in length from three or four inches at the base of the panicle to an inch and a half at its apex and, like the short secondary branches, are bright orange color. The flowers, which open in June and occasionally also irregularly in November and are white and slightly fragrant, are raised on short thick disk-like pedicels and are about an eighth of an inch long; they consist of a cupular six-lobed perianth with broadly ovate acute lobes, six stamens with nearly triangular filaments united at the base, and oblong versatile anthers, and an ovate ovary gradually narrowed into a stout thick style dilated into a broad funnel-shaped flat stigma. The fruit, which ripens in October and also irregularly late in the spring or in early summer, is lustrous, ivory-white, and from one sixteenth to nearly one quarter of an inch in diameter, with thin flesh and a pale chestnut-brown seed three sixteenths of an inch in diameter, penetrated only to the middle by the basal cavity.

Thrinax Keyensis, which is the largest and handsomest of the fan-leaved Palms of tropical Florida, grows in dry sandy soil close to the beach on the north side of the largest of the Marquesas keys, where, mingled with *Coccothrinax jucunda*, it lifts its broad and stately head of massive foliage above the low shrubby undergrowth of *Rhus Metopium*, *Conocarpus erecta*, *Jacquinia armillaris*, and *Eugenia buxifolia*. It grows also on Crab Key, a small island to the westward of Torch Key, one of the Bahia Honda group.[1]

[1] This Palm was first seen by me on the Marquesas keys in November, 1886, without flowers or fruit and was incorrectly referred to Euthrinax (*Garden and Forest*, ix. 162; *Silva N. Am.* x. 50) in the belief that the thick fleshy black fruit of *Coccothrinax jucunda* belonged to it.

EXPLANATION OF THE PLATE.

PLATE DCCXXXVI. THRINAX KEYENSIS.

1. A portion of a flowering spadix, natural size.
2. A flower, enlarged.
3. Perianth of a flower laid open, with its stamens, enlarged.
4. A pistil, enlarged.
5. A portion of a fruiting spadix, natural size.
6. Vertical section of a fruit, enlarged.
7. A seed, enlarged.
8. A seed, enlarged.
9. A leaf, much reduced.
10. A ligule, natural size.

C.E. Faxon del. Rapine sc.

THRINAX KEYENSIS. Sarg.

A. Riocreux dirext Imp. J. Taneur, Paris.

COCCOTHRINAX.

FLOWERS perfect; calyx and corolla confluent into a six-toothed perianth; stamens 9; ovary 1-celled; ovule basilar, erect. Fruit baccate, globose, black, and lustrous. Spadix interfoliar, paniculate. Leaves orbicular, or truncate at the base, petiolate, their petioles unarmed.

Coccothrinax, Sargent, *Bot. Gazette*, xxvii. 87 (1899).

Thrinax, Endlicher, *Gen.* 253 (in part) (1836). — Meissner, *Gen.* 357 (in part). — Bentham & Hooker, *Gen.* iii. 930. — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 34 (sect. *Euthrinax*). — Baillon, *Hist. Pl.* xiii. 317 (excel. sect. *Hemithrinax*). — Sargent, *Silva N. Am.* x. 49 (sect. *Euthrinax*).

Small unarmed trees, with simple or clustered endogenous stems marked below by the ring-like scars of fallen leaves and clothed above with the long persistent petiole-sheaths, or rarely stemless. Leaves terminal, induplicate in vernation, alternate, orbicular, or truncate at the base, pale or silvery white on the lower surface, more or less deeply divided into narrow acute two-parted plicately folded lobes; rachis short; ligule thin, free, erect, concave, rounded or long-pointed at the apex; petioles compressed, slightly rounded and ridged on both sides, their margins thin and smooth, gradually enlarged below into elongated vaginas of coarse fibres, often forming an open conspicuous network, generally clothed while young with thick hoary tomentum. Spadix interfoliar, paniculate, shorter than the petioles, its primary branches furnished with numerous short slender pendulous flower-bearing secondary branchlets from the axils of scarious acute bracts; spathes numerous, tubular, papyraceous, two-cleft at the apex, inserted on the rachis of the panicle, each primary branch with its spathe and the node of the rachis below it inclosed in a separate spathe, the whole surrounded by the larger spathe of the node next below. Flowers perfect, solitary, minute, articulate on slender elongated pedicels in the axils of caducous bracts. Perianth cupular, truncate at the base, obscurely six-lobed, deciduous. Stamens nine, inserted on the base of the perianth, exserted; filaments subulate, enlarged and barely united at the base; anthers oblong, attached on the back near the middle, introrse, two-celled, the cells opening longitudinally. Ovary superior, ovoid, one-celled, narrowed above into a slender columnar style crowned by a funnel-formed oblique stigma; ovule solitary, basilar, anatropous; micropyle sublateral. Fruit subglobose, buccate, one-seeded, crowned by the remnants of the style, raised on the thickened torus of the flower; exocarp at first thin, of two closely united coats, the outer crustaceous, bright green, the inner membranaceous, silvery white; in ripening becoming thick, sweet, juicy, homogeneous, black, and lustrous. Seed erect, free, depressed-globose; testa thick and hard, vertically grooved, deeply infolded in the ruminate albumen; hilum subbasilar, minute, and obscure; raphe hidden in the folds of the testa. Embryo lateral.

Coccothrinax is confined to southern Florida and to the Bahama and West Indian islands. Two species occur in Florida; one of them is a small tree, and the other a low nearly stemless plant.[1] *Coccothrinax radiata*[2] inhabits Cuba, Antigua, San Domingo, and Trinidad, and *Coccothrinax argentea*[3]

[1] *Coccothrinax Garberi*, Sargent, *Bot. Gazette*, xxvii. 90 (1899).

Thrinax Garberi, Chapman, *Bot. Gazette*, iii. 12 (1878); *Fl.* ed. 2, Suppl. 651. — Sargent, *Silva N. Am.* x. 50.

Thrinax argentea, var. *Garberi*, Chapman, *Fl.* ed. 3, 462 (1897).

[2] Sargent, *Bot. Gazette*, xxvii. 89 (1899).

Thrinax radiata, Roemer & Schultes, *Syst.* vii. pt. ii. 1301 (1830). — Martius, *Nat. Hist. Palm.* iii. 257. — Grisebach, *Fl. Brit. W. Ind.* 515; *Cat. Pl. Cub.* 221.

[3] Sargent, *l. c.* (1899).

Thrinax argentea, Roemer & Schultes, *l. c.* (1830). — Martius, *l. c.* 256. — Grisebach, *l. c.*; *l. c.*

the Bahamas, San Domingo, and Cuba, where there appear also to be other little known or undescribed species.

The stems of Coccothrinax are used for wharf-piles and the sides of turtle crawls, and the tough coriaceous leaves are made into hats, baskets, and coarse ropes, and are used for the thatch of buildings.

The generic name from κόκκος and *Thrinax* is in allusion to the berry-like fruit.

COCCOTHRINAX JUCUNDA.

Brittle Thatch.

PEDICELS stout, elongated; filaments subulate, barely united. Fruit black, with thick juicy succulent flesh; seeds light tawny brown, conspicuously sulcate.

Coccothrinax jucunda, Sargent, *Bot. Gazette*, xxvii. 89 (1899).

Thrinax parviflora, Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 217 (not Swartz nor Chapman) (1884); *Silva N. Am.* x. 51 (in part), t. 510 (excl. figure of the leaf).

Thrinax argentea, Chapman, *Fl.* ed. 3, 462 (not Roemer & Schultes) (1897).

A tree, with a stem slightly enlarged from the ground upward, and from fifteen to twenty-five feet in height, from four to six inches in thickness, and covered with a pale blue-gray rind. The leaves are nearly orbicular, the lower lobes being usually parallel with the petiole, but are rather longer than they are broad, thin and brittle, from eighteen to twenty-four inches in diameter, and divided below the middle of the leaf or towards its base nearly to the ligule into narrow lobes which in their widest part are an inch across, and are furnished with much thickened bright orange-colored midribs and margins; the leaves are pale yellow-green and very lustrous on the upper surface and bright silvery white on the lower surface, which is at first coated with hoary deciduous pubescence; the rachis of the leaf is thin, undulate, obtusely short-pointed, and dark orange-colored, and the ligule is thin, concave, crescent-shaped, often oblique, slightly undulate, occasionally obtusely short-pointed, three quarters of an inch wide, one third of an inch deep, and light or dark orange-colored; the petioles are slender, flexible, at first erect but soon spreading and then pendant, rounded on the upper side, obscurely ribbed on the lower side, with a low rounded rib, from two feet and a half to three feet long, pale yellow-green, an inch and a half wide at the base, and coated at first with silvery white deciduous tomentum toward the dark orange-colored apex which is about five eighths of an inch in width. The panicles are from eighteen to twenty-four inches in length, with flattened peduncles, slender much flattened primary branches from eight to ten inches long, and light orange-colored like the slender terete secondary branches which are from an inch and a half to three inches long; their spathes are thin, fibrous, and pale reddish brown, and are coated towards the ends with pale pubescence. The flowers, which expand in June and irregularly also in the autumn, are raised on ridged spreading pedicels an eighth of an inch in length and consist of a cup-like six-lobed perianth, nine stamens with slender exserted filaments slightly united below, and large oblong light yellow anthers, and a subglobose orange-colored ovary surmounted by an elongated style dilated into a broad rose-colored stigma. The fruit, which ripens in about six months, is from one half to three quarters of an inch in diameter, and bright green at first when fully grown; it then turns deep violet color, and the flesh becomes very succulent and filled with violet-colored juice; ultimately it is nearly black and very lustrous, the whole pericarp becoming sweet with an agreeable flavor, and then shriveling it grows leathery in drying. The seed is light tawny brown, with a thick hard dull testa which is deeply infolded in the ruminate albumen.

Coccothrinax jucunda is now known only in Florida, where it inhabits dry coral ridges and sandy flats from the shores of Bay Biscayne, along many of the southern keys, to the Marquesas group west of Key West.

The stems are used for the piles of small wharves and for turtle crawls, and the soft tough young leaves are made into hats and baskets.

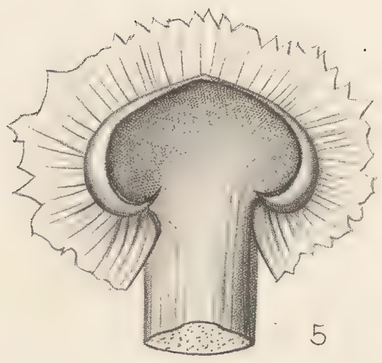
Coccothrinax jucunda was discovered in 1880 by Mr. A. H. Curtiss [1] on Bahia Honda Key. The specific name is in allusion to the sweet edible flesh of the fruit.

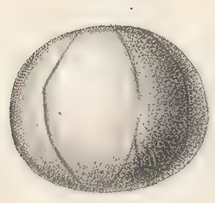
[1] See ii. 50.

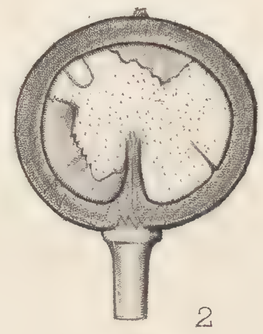
EXPLANATION OF THE PLATE.

PLATE DCCXXXVII. COCCOTHRINAX JUCUNDA.

1. A portion of a fruiting spadix, natural size.
2. Vertical section of a fruit, enlarged.
3. A seed, enlarged.
4. A leaf, much reduced.
5. A ligule, natural size.







C.E.Faxon del.

Em.Himely sc.

COCCOTHRINAX JUCUNDA, Sag.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

JUNIPERUS BARBADENSIS.

Red Cedar.

STAMINATE flowers elongated. Fruit small, subglobose; seeds usually two. Leaves opposite, acute or acuminate, glandular. Branchlets slender, pendulous.

Juniperus Barbadensis, Linnæus, *Spec.* 1039 (1753). — Lamarck, *Dict.* ii. 627. — Michaux, *Fl. Bor.-Am.* ii. 245. — Willdenow, *Spec.* iv. pt. ii. 851. — Pursh. *Fl. Am. Sept.* ii. 647. — Nuttall, *Gen.* ii. 245; *Sylva*, iii. 96. — Sprengel, *Syst.* iii. 909. — Maycock, *Fl. Barb.* 394. — Loudon, *Arb. Brit.* iv. 2504. — Engelmann, *Trans. St. Louis Acad.* iii. 592. — Mohr, *Contrib. U. S. Nat. Herb.* vi. 326 (*Plant Life of Alabama*); *Bull.* No. 31 *Div. Forestry U. S. Dept. Agric.* 37, t. 2.

Juniperus Bermudiana, Lunan, *Hort. Jam.* i. 84 (not Linnæus) (1814). — Rafinesque, *Med. Fl.* ii. 13 (in part). — Gordon, *Pinetum*, 101 (in part). — Henkel & Hochstetter, *Syn. Nadelh.* 328 (in part). — Carrière, *Traité Conif.* ed. 2, 49 (in part). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 490. — Sargent, *Silva N. Am.* x. 70 (in part).

Juniperus Virginiana, B **australis**, Endlicher, *Syn. Conif.* 28 (1847). — Carrière, *Traité Conif.* 44. — Courtin, *Fam. Conif.* 131.

Juniperus Virginiana, Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 202 (in part) (not Linnæus) (1850). — Courtin, *Fam. Conif.* 130 (in part). — Chapman, *Fl.* 435 (in part). — Carrière, *Traité Conif.* ed. 2, 43 (in part). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 182 (in part); *Silva N. Am.* x. 93 (in part). — Masters, *Jour. R. Hort. Soc.* xiv. 215 (in part); *Jour. Bot.* xxxvii. 10. — Hansen, *Jour. R. Hort. Soc.* xiv. 298 (*Pinetum Danicum*) (in part).

Juniperus Virginiana Barbadensis, Gordon, *Pinetum*, 114 (1858). — Henkel & Hochstetter, *Syn. Nadelh.* 337. — Hoopes, *Evergreens*, 293.

Juniperus Virginiana, var. **Bermudiana**, Vasey, *Rep. U. S. Dept. Agric.* 1875, 185 (*Cat. Forest Trees U. S.*) (1876).

Since the tenth volume of this work was published in 1896 I have had several opportunities to restudy in the field the Red Cedars of North America, and it now seems necessary to separate *Juniperus Virginiana* as there described into three species: —

First, the *Juniperus Virginiana* of Linnæus, the Red Cedar of the north, with comparatively stout branchlets, erect branches which usually make a narrow compact pyramidal head, or sometimes in old age become more horizontal and form an open round-topped crown, and fruit which ripens at the end of the first season.[1] Second, the Red Cedar of the Florida peninsula with more slender pendulous branchlets and long often pendulous branches which spread into a broad open head and smaller fruit ripening at the end of the first season. Third, the Red Cedar of western America with rather stouter branchlets, fruit which does not ripen until the end of the second season, and lighter colored usually reddish brown wood.

In Florida the Red Cedar, which is not distinguishable from *Juniperus Barbadensis*[2] of the West Indies, is a tree sometimes fifty feet in height, with a trunk occasionally two feet in diameter covered with thin light red-brown bark which separates into long thin scales and small branches which are erect when the tree is crowded in the forest, but in open ground are ascending and spreading and form a

[1] As thus limited the range of *Juniperus Virginiana* is from southern Nova Scotia and New Brunswick westward to eastern Nebraska, Kansas, and the Indian Territory, and southward to the coast of South Carolina or Georgia, the limestone hills of the interior of southern Alabama and Mississippi and eastern Texas.

[2] Linnæus's specimen of *Juniperus Barbadensis* preserved in his herbarium at London represents a thin-branched species which is not distinguishable from the West Indian and Florida tree, and this specimen may properly be considered the type of *Juniperus Barbadensis* in spite of the fact that Linnæus evidently confounded the West Indian and Bermuda species, both of which he described, for he refers to his *Juniperus Barbadensis* the "*Juniperus Barbadensis, Cupressi foliis, ramulis quadratis*" of Plukenet (*Alm. Bot.* 201, t. 197, f. 4) and the *Juniperus Bermudiana* of Miller (*Cat. Pl. Hort. Angl.* t. 1, f. 1), which are both shown by these figures to be thick-branched species. Of the identity of the former there is some doubt, but the figure in the *Cat. Pl. Hort. Angl.* admirably represents the Bermuda Juniper. Hermann's *Juniperus Bermudiana* (*Cat. Hort. Lugd. Bat.* 345, t.), which Linnæus referred to his species of that name, is probably some other species.

broad flat-topped head often thirty or forty feet in diameter. The secondary branches are long and slender, and are erect at the top of the tree and pendulous on the lower branches. The staminate trees are of open habit, with light-colored yellow-green foliage, and the pistillate trees are of more compact habit, with dark green foliage. The branchlets are slender, four-angled, pendulous, and at the end of four or five years, when the leaves disappear, are light reddish brown or ashy gray. The leaves are opposite in pairs, closely impressed, narrow, acute or gradually narrowed above the middle and acuminate, and marked on the back by a conspicuous oblong gland. The flowers are dicœcious and in Florida open early in March. The staminate flowers are oblong, elongated, and from an eighth to nearly a quarter of an inch in length, with rounded entire anther-scales which bear usually three pollen sacs. The scales of the pistillate flowers are gradually narrowed above the middle and acute at the apex, and become obliterated from the fruit. This is subglobose, dark blue, and covered when ripe with a glaucous bloom, and is usually only about an eighth of an inch in diameter, with sweet resinuous flesh and usually two seeds.

In the United States *Juniperus Barbadensis* is distributed along the Atlantic coast from southern Georgia to the shores of the Indian River, Florida, and on the Gulf coast from the northern shores of Charlotte Harbor, Florida, to the valley of the Appalachicola, growing usually in inundated river-swamps and forming great thickets in forests of Taxodium, Red Maple, Gordonia, Loblolly Pine, Swamp Oaks, Palmetto, and Liquidambar;[1] and in the West Indies it grows on the Bahamas,[2] San Domingo,[3] the Mountains of Jamaica,[4] and on Antigua.[5]

The wood, which resembles that of the Red Cedar of the north in color and fragrance, is straighter-grained and more easily worked, and for many years and until the supply begun to become exhausted it was exclusively used by the German manufacturers of pencils, who have established large factories for cutting this wood at Cedar Keys and other places on the Florida coast.

Juniperus Barbadensis, with its long spreading branches and elongated gracefully drooping branchlets, is one of the most beautiful of all Junipers, and it has been largely used for the decoration of the squares and cemeteries of the cities and towns in the neighborhood of the coast from Florida to western Louisiana.[6]

[1] Near Tallahassee, Florida, and along the coast of Alabama, Mississippi, and eastern Louisiana *Juniperus Barbadensis* is common in the neighborbood of towns and appears to be thoroughly naturalized and to be gradually spreading into adjacent woodlands. The fact, however, that west of the Appalachicola it does not grow in swamps or remote from human habitations seems to indicate that the Junipers now in this region have sprung from trees which were planted there not very long ago. *Juniperus Barbadensis* is the most universally planted coniferous tree in New Orleans and in the towns of western Louisiana, but there is even less evidence that it is indigenous in the region beyond the Mississippi.

[2] Eggers, No. 4358 in herb. Kew.

[3] Eggers, No. 2320 in herb. Kew.

[4] "*Juniperus Barbadensis* is now somewhat rare on the Blue Mountains, but it is evident that it was confined to an elevation ranging between thirty-five hundred and six thousand feet in later years. Formerly it may have ranged much lower, as it grows well even near the sea-level if it gets plenty of water. The wood is valued so much that all the trees that were easily reached have been cut down. I think the height may be put down from forty to fifty feet and the girth of the trunk at from two to four feet." (W. Fawcett, *in litt.*)

[5] Grisebach, *Fl. Brit. W. Ind.* 503.

[6] The Bedford Juniper which is occasionally cultivated in European collections is possibly of this species. (For the synonymy of this plant see x. 96; see, also, Veitch, *Man. Conif.* ed. 2, 193.)

EXPLANATION OF THE PLATE.

PLATE DCCXXXVIII. JUNIPERUS BARBADENSIS.

1. A flowering branch of a staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A branch of a pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. Cross section of a fruit, enlarged.
9. A seed, enlarged.
10. The end of a branchlet, enlarged.
11. A leaf, enlarged.

C.E. Faxon del.

Rapine sc.

JUNIPERUS BARBADENSIS, L.

A. Riocreux direx.t

Imp. J. Taneur, Paris

JUNIPERUS SCOPULORUM.

Red Cedar.

FRUIT subglobose, ripening at the end of the second season, usually 2-seeded. Leaves opposite, acute, glandular. Branchlets slender.

Juniperus scopulorum, Sargent, *Garden and Forest*, x. 420, f. 54 (1897). — Nelson, *Bull.* No. 40, *Wyoming Exper. Stat.* 86, f. 16, 17 (*Trees of Wyoming*). — Rydberg, *Mem. N. Y. Bot. Gard.* i. 13 (*Fl. Montana*). — Bessey, *Rep. Nebraska State Board Agric.* 1897, 83.

Juniperus excelsa, Pursh, *Fl. Am. Sept.* ii. 647 (not Marschall von Bieberstein) (1814). — Nuttall, *Gen.* ii. 245.

Juniperus Virginiana, Torrey, *Ann. Lyc. N. Y.* ii. 250 (not Linnæus) (1838); *Emory's Rep.* Appx. No. 6, 412; *Pacific R. R. Rep.* iv. pt. v. 142; *Bot. Mex. Bound. Surv.* 211. — Lyall, *Jour. Linn. Soc.* vii. 144. — *Cooper, Am. Nat.* iii. 413. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 488 (in part). — Engelmann, *Trans. St. Louis Acad.* iii. 591 (in part); *Rothrock Wheeler's Rep.* vi. 263. — Watson, *King's Rep.* v. 335. — Porter & Coulter, *Fl. Colorado; Hayden's Surv. Misc. Pub.* No. 4, 132. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 182 (in part); *Silva N. Am.* x. 93 (in part). — Tweedy, *Flora of the Yellowstone National Park*, 74. — Macoun, *Garden and Forest*, i. 47 (*The Forests of Vancouver Island*). — Britton, *Trans. N. Y. Acad. Sci.* viii. 74. — Masters, *Jour. R. Hort. Soc.* xiv. 215 (in part). — Hansen, *Jour. R. Hort. Soc.* xiv. 298 (*Pinetum Danicum*) (in part). — Britton & Kearney, *Trans. N. Y. Acad.* xiv. 22. — Leiberg, *Contrib. U. S. Nat. Herb.* v. 55.

Juniperus occidentalis, Porter, *Hayden U. S. Geolog. Surv. Montana* (*5th Ann. Rep. of Progress*), 494 (not Hooker) (1872). — Macoun, *Cat. Can. Pl.* 461.

Juniperus Virginiana, var. **montana**, Vasey, *Rep. U. S. Dept. Agric.* 1875, 185 (*Cat. Forest Trees U. S.*) (not *J. communis*, γ *montana*, Aiton) (1876).

A tree, thirty or forty feet in height, with a short stout trunk sometimes three feet in diameter, and often divided near the ground into a number of slightly spreading stems, and stout spreading and ascending branches covered with scaly bark which form an open irregularly round-topped head.[1] The bark of the trunk is dark reddish brown or gray tinged with red, and is divided by shallow fissures into narrow flat connected ridges which break up on the surface into persistent shredded scales. The branchlets are slender and four-angled, becoming terete at the end of three or four years, when they are covered with smooth pale bark which a few years later begins to seperate into thin scales. The leaves are opposite in pairs, closely appressed, acute or acuminate, marked on the back by an obscure elongated gland, and dark green, or on trees in the southern Rocky Mountains often pale and very glaucous. The staminate flowers are oblong and about one sixteenth of an inch in length, and their anther-scales are rounded and entire, with four or five anther-sacs. The scales of the pistillate flower are spreading and acute or acuminate, and become obliterated on the mature fruit. At the end of the first season the fruit is about one sixteenth of an inch in length and blue or rose color, and beginning to grow the following spring it becomes before autumn from one quarter to one third of an inch in diameter, bright blue, and covered with a glaucous bloom, and has sweet resinous flesh, and one or generally two seeds. The seeds are ovate, acute, prominently grooved and angled, light chestnut-brown, about three sixteenths of an inch long, and lustrous, with a small two-lobed hilum.

Juniperus scopulorum is distributed through the eastern foothill region of the Rocky Mountains from Alberta to western Texas, and westward to the coast of British Columbia[2] and Washington, and

[1] At Manitou at the base of Pike's Peak *Juniperus scopulorum* in sheltered positions develops long slightly pendulous branches, and is a handsome tree of open habit, while on the more arid wind-swept slopes the branches are short and rigid and form a compact round-topped head.

[2] In 1876 *Juniperus scopulorum* was collected by Dawson on the gravelly margin of Francois Lake in British Columbia in latitude 54° north. This is the most northern station from which I have specimens of this tree. (See G. M. Dawson, *Garden and Forest*, i. 59, as *Juniperus Virginiana*.)

to eastern Oregon, Nevada, and northern Arizona.[1] Nowhere very common, it grows on dry rocky ridges, and except near the coast usually at elevations of more than five thousand feet above the level of the sea.

Juniperus scopulorum was discovered in October, 1804, by Lewis and Clark during their journey across the continent.[2]

[1] In 1846 *Juniperus scopulorum* was found by Wislizenus in New Mexico (No. 503 in herb. Engelmann); and the following year by Fendler at Santa Fé (No. 835), where this Juniper is comparatively common. In April, 1874, it was collected by Dr. J. B. Gerard near Fort Apache, Arizona. (*Teste* herb. Engelmann.)

[2] Lewis and Clark's specimen preserved by the American Philosophical Society shows that the tree called by Pursh and by Nuttall *Juniperus excelsa* was *Juniperus scopulorum*, and not, as has usually been supposed, the *Juniperus occidentalis* of Hooker.

EXPLANATION OF THE PLATE.

PLATE DCCXXXIX. JUNIPERUS SCOPULORUM.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. An anther, rear view, enlarged.
4. A branch with pistillate flowers, natural size.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower, upper side, with its ovules, enlarged.
7. A fruiting branch, natural size.
8. A fruit divided transversely, enlarged.
9. A seed, enlarged.
10. End of a branchlet, enlarged.
11. Tip of a leaf, enlarged.

C.E Faxon del. Rapine sc.

JUNIPERUS SCOPULORUM, Sarg.

A. Riocreux direx.t Imp. J. Taneur, Paris.

CUPRESSUS PYGMÆA.

Cypress.

SCALES of the fruit 6 to 10; seeds compressed, black. Branchlets stout. Leaves dark green, eglandular.

Cupressus pygmæa, Sargent, *Bot. Gazette*, xxxi. 239 (1891).

Cupressus Goveniana, var. **pygmæa**, Lemmon, *Handb. West American Cone-Bearers*, 77 (1895).

Cupressus Goveniana, Sargent, *Silva N. Am.* x. 107 (in part) (not Gordon) (1896).

A tree, sometimes thirty or forty feet in height, with a trunk rarely more than a foot in diameter, and ascending branches. The bark of the trunk is bright reddish brown, about a quarter of an inch in thickness, and divided by shallow fissures into flat ridges which separate on the surface into long thread-like scales. The branchlets, which are comparatively stout, are bright orange color when they first appear, bright reddish brown during one or two seasons, and then turning purple become dark reddish brown at the end of several years. The leaves are ovate, acute, or acuminate on vigorous shoots, dark green, and eglandular. The staminate flowers are obscurely four-angled, with broadly ovate peltate connectives, and the fertile scales of the pistillate flowers, which vary from six to ten in number, are acute and spreading. The fruit is short-oblong, usually sessile, and from three quarters to seven eighths of an inch in length, with from six to ten scales terminating in small bosses. The seeds are compressed, only about one eighth of an inch long, and black.

Cupressus pygmæa inhabits the high barren region near the coast of Mendocino County, California, which extends from Ten Mile Run on the north to the Navarro on the south. Here it grows on deposits of sand and a thin coat of peat, overlaying a heavy yellow clay in a narrow belt which, beginning about three quarters of a mile from the ocean, extends inland for three or four miles.[1]

The wood of *Cupressus pygmæa* is soft, very coarse-grained, and pale reddish brown.[2]

[1] On this poor soil the plants begin to bear cones when only a foot or two high, but on the borders of the barrens and of the deep gullies which penetrate them, where the plants occasionally escape for several years the fires which almost annually sweep over this region, they often grow in better soil to a height of thirty or forty feet, although from overcrowding they rarely develop the spreading branches which are peculiar to Cupressus growing in abundant space.

The name pygmæa used by Lemmon to distinguish the dwarf plant stunted by overcrowding and insufficient nourishment is unfortunate as a specific name, for there is no difference between the smallest and the largest plants except in size; and it is probable that individuals on the borders of the barrens, if they could be protected from fire, would in time grow to a large size, for the oldest plants now standing show no signs of maturity and none of them are thought to be more than fifty years old. (*Teste* Purdy, *in litt.*)

[2] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is eleven and one half inches in diameter inside the bark, and is thirty-six years old. The sapwood is two inches thick, with thirteen layers of annual growth.

EXPLANATION OF THE PLATE.

Plate DCCXL. Cupressus pygmæa.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A scale of a staminate flower with its anthers, enlarged.
4. A branch of a pistillate tree with flowers and fruit, natural size.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower, upper surface, with its ovules, enlarged.
7. A scale of a cone, side view, with its seeds, enlarged.
8. Seeds, enlarged.
9. Tip of a branch, enlarged.

C.E.Faxon del.

Rapine sc.

CUPRESSUS PYGMÆA, Sarg.

A.Riocreux dirext.

Imp. J.Taneur, Paris.

CORRECTIONS.

Investigations made since the earlier volumes of this Silva were published have shown the necessity of correcting the descriptions of several species. A few of these corrections have already been printed; the others will be found in the following notes: —

Magnolia fœtida, i. 3. *Magnolia grandiflora* was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 1082).

Magnolia glauca, i. 5. *Magnolia glauca* was first used by Linnæus as a name of a species in 1759 in the tenth edition of the *Systema* (ii. 1082).

Extend range westward in Pennsylvania to swamps on the South Mountain at the head of the east fork of the Conococheague River, Franklin County. (*Teste* Miss M. L. Dock, *Garden and Forest*, x. 402. See, also, *Garden and Forest*, vii. 398; viii. 79.)

Magnolia acuminata, i. 7. This name was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 1082).

Magnolia tripetala, i. 13. This name was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 1082).

Extend range to the valley of the Susquehanna River in York County, Pennsylvania, where it has been found near York Furnace and at Reed's Run by Professor T. C. Porter, and where it is rare and local. (See Porter, *Bull. Torrey Bot. Club*, xxv. 489.)

Liriodendron Tulipifera, i. 19. Add to the synonyms *Tulipifera Liriodendron*, Miller, *Dict.* ed. 8 (1768).

Asimina triloba, i. 23. Extend range to western New Jersey and to southeastern Nebraska, where it has been found in Pawnee, Richardson, Nemaha, Otoe, and Saunders counties. (See Bessey, *Rep. Nebraska State Board Agric.* 1899, 84.)

"In eastern Pennsylvania *Asimina triloba* is common along the lower Susquehanna and its tributaries, and on the Juniata in Mifflin and Huntingdon counties, where I found it at the head of a mountain stream sixteen hundred feet above the level of the sea." (Professor T. C. Porter, *in litt.* See *Bull. Torrey Bot. Club*, xxv. 489.)

Canella alba, i. 37. This tree was described by Linnæus in the first edition of the *Species Plantarum*, published in 1753 as *Laurus Winterana*, while the name *Canella alba* of Murray was not published until 1784, and, under the rules of nomenclature adopted in this work, *Canella Winterana* of Gærtner, published in 1788 and already adopted by Sudworth, must be taken up for it. (See *Bull. Torrey Bot. Club*, xx. 46; *Bull.* No. 14 *Div. Forestry U. S. Dept. Agric.* 273 [*Nomenclature of the Arborescent Flora of the United States*].)

Fremontia, i. 47. Fremontia having been a synonym when it was used in 1853 by Torrey as the name of his genus in *Cheiranthodendreæ*, the name cannot be retained for this California tree under the rules of nomenclature followed in this work; and Fremontodendron of Coville is adopted. (See *Contrib. U. S. Nat. Herb.* iv. 74 [*Bot. Death Valley Exped.*] [1893].)

Fremontodendron Californicum. Extend range northward to Siskiyou County, California, where it was collected by Miss A. M. Huntley in June, 1896, near Sisson, at the western base of Mt. Shasta. In August, 1892, it was found by Mrs. T. S. Brandegee on Snow Mountain in Lake County, one of the highest peaks of the California coast ranges.

Tilia heterophylla, i. 57. The northern limits of the range of this species in Pennsylvania are, according to Professor T. C. Porter, Huntingdon County, where it grows on the banks of the Juniata River; it also grows in Franklin County on the Conococheague. (Porter, *in litt.*)

Xanthoxylum, i. 65. The author of Fagara is Linnæus, *Syst.* ed. 10 (ii. 897), published in 1759, and not Adanson, *Fam. Pl.* published in 1763.

Xanthoxylum Fagara, i. 73. *Fagara Pterota* was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 897).

Xanthoxylum cribrosum, i. 71. According to Urban (*Bot. Jahrb.* xi. 571) an older name for this tree is that of Vahl, *Xanthoxylum flavum*. The synonymy as corrected is as follows: —

Xanthoxylum flavum, Vahl, *Eclog.* iii. 48 (1807); *Skrivt. Nat. Selsk. Kjöbenh.* vi. 133. — Eggers, *Bull. U. S. Nat. Herb.* No. 13, 38 (*Fl. St. Croix and the Virgin Islands*). — Robinson, *Gray Syn. Fl. N. Am.* i. pt. i. 375.

Xanthoxylum Clava-Herculis, De Candolle, *Prodr.* i. 727 (excl. syn.) (not Linnæus) (*teste* Urban, *l. c.*) (1824).

Xanthoxylum cribrosum, Sprengel, *Syst.* i. 946 (1825). — Sargent, *Garden and Forest*, ii. 616; *Silva N. Am.* i. 71, t. 30, 31.

Xanthoxylum Floridanum, Nuttall, *Sylva*, iii. 14, t. 85 (1854). — Chapman, *Fl.* 66.

Xanthoxylum Sumach, Grisebach, *Abhand. König. Gesell. Wiss. Göttingen*, 190 (*Veg. Karaib.*) (not Macfadyen) (1857); *Fl. Brit. W. Ind.* 138. — Walpers, *Ann.* vii. 528. — Eggers, *Vidensk. Medd. fra Nat. For. Kjöbenh.* 1876, 108 (*Fl. St. Croix*).

Xanthoxylum Caribæum, Watson, *Ind.* 155 (not Lambert) (1878).

Xanthoxylum Caribæum, var. *Floridanum*, Gray, *Proc. Am. Acad.* n. ser. xxiii. 225 (1888).

Fagara flava, Urban, *Bot. Jahrb.* xxi. 571 (1896).

Ptelea trifoliata, i. 76. Extend range southward in Florida to the neighborhood of Eustis, Lake County, where it was collected in June, 1894, by Mr. George B. Nash.

Amyris maritima, i. 85. In the first volume of this work the name of *Amyris maritima* of Jacquin was adopted for this Florida tree. This name was first published in 1760; and the fact was overlooked that Linnæus had used for it the name of *Amyris Elemifera* in the tenth edition of his *Systema*, published three years earlier than the second edition of the *Species Plantarum*. *Amyris Elemifera* should therefore be adopted for the Florida plant, although Urban (*Bot. Jahrb.* xxi. 601) would separate the *Amyris maritima* of Jacquin from the *Amyris Elemifera* of Linnæus on the strength of the presence of a disk in the flower of the former and of the minute and variable pubescence of the latter, — differences which Robinson has pointed out are of little value. The two species being united, the synonymy of our south Florida tree becomes, —

Amyris Elemifera, Linnæus, *Syst.* ed. 10, ii. 1000 (1759); *Spec.* ed. 2, i. 495; *Amœn. Acad.* vii. 65. — Descourtilz, *Fl. Med. Antill.* iii. 279, t. 212. — Triana & Planchon, *Ann. Sci. Nat.* sér. 5, xiv. 324. — Urban, *Bot. Jahrb.* xxi. 601. — Robinson, *Gray Syn. Fl. N. Am.* i. pt. i. 376.

Amyris maritima, Jacquin, *Enum. Pl. Carib.* 19 (1760); *Hist. Stirp. Am.* 107. — Linnæus, *Spec.* ed. 2, i. 496 (excl. syn. P. Browne). — Swartz, *Obs.* 148. — Sprengel, *Syst.* ii. 218. — De Candolle, *Prodr.* ii. 81. — Macfadyen, *Fl. Jam.* i. 231. — Grisebach, *Fl. Brit. W. Ind.* 174. — Baillon, *Hist. Pl.* iv. 397, f. 447–451; *Dict.* i. 159, f. — Gray, *Proc. Am. Acad.* xxiii. 226. — Sargent, *Silva N. Am.* i. 85, t. 36.

Amyris Floridana, Nuttall, *Am. Jour. Sci.* v. 294 (1822); *Sylva*, ii. 114, t. 78. — Torrey & Gray, *Fl. N. Am.* i. 221. — Loudon, *Arb. Brit.* ii. 561. — Chapman, *Fl.* 68.

Amyris sylvatica, De Candolle, *Prodr.* ii. 81 (1825). — Grisebach, *Fl. Brit. W. Ind.* 174 (in part). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 33.

Amyris Plumieri, Grisebach, *Cat. Pl. Cub.* 66 (1866). — Sauvalle, *Fl. Cub.* 20.

Amyris maritima, var. *angustifolia*, Gray, *Proc. Am. Acad.* n. ser. xxiii. 226 (1888).

Amyris sylvatica, var. *Plumieri*, Maza, *Anal. Soc. Esp. Hist. Nat.* xix. 229 (1890).

Elemifera maritima, Otto Kuntze, *Rev. Gen.* i. 100 (1891).

Kœberlinia spinosa, i. 93. Extend range westward through southern New Mexico and Arizona to the foothills and mesas in the neighborhood of Tucson, where it is very abundant as a broad low shrub.

Ilex Paraguariensis, i. 104. For the synonymy of the different species of Ilex and other plants from which Maté or Paraguay Tea is obtained, see N. E. Brown, *Kew Bull. Miscellaneous Information*, May and June, 1892, 132.

Ilex decidua, i. 113. Extend range to southeastern Kansas (Hitchcock, *Flora of Kansas*, xii. *a*).

Evonymus atropurpureus, ii. 11. This tree occurs occasionally in woods in the valley of the Sioux River in the extreme southeastern part of South Dakota and ranges up the valley of the Missouri River into Charles Mix County (see Saunders, *Bull.* No. 64 *South Dakota Agric. College*, 169 [*Ferns and Flowering Plants of South Dakota*]); extend range also to central Kansas (Hitchcock, *Flora of Kansas*, xii. *a*).

Rhamnus Caroliniana, ii. 35. The range of this species from Long Island, New York, should be emended to read from Virginia. The northern station was admitted on the authority of the Catalogues of New York and of New Jersey Plants (Britton, Stearns & Poggenburg, *Cat. Pl. N. Y.* 11 [1888]; Britton, *Cat. Pl. N. J.* 76 [1889]); but it now appears that the Rhamnus of Long Island and New Jersey referred to this species is *Rhamnus Frangula*, Linnæus, which has escaped from cultivation and become naturalized. (See Britton, *Bull. Torrey Bot. Club*, xxi. 184, 233. — Britton & Brown, *Ill. Fl.* ii. 406.)

Rhamnus Purshiana, ii. 27. It was not in Siberia, but at Grossenhain in Saxony, that Frederick Pursh was born on February 4, 1774. (See C. A. Pursch, *Flora*, 1827, ii. 491.)

Æsculus glabra, ii. 55. Extend range westward to Pawnee, Richardson, and Nemaha counties, southeastern Nebraska (Bessey, *Rep. Nebraska State Board Agric.* 1899, 89), and to eastern Texas.

The Texas form is, —

Æsculus glabra. var. *Buckleyi.*

Æsculus arguta, Buckley, *Proc. Phil. Acad.* 1860, 443 (not *Æsculus Pavia*, var. *arguta*, Lindley). — Britton & Brown, *Ill. Fl.* ii. 401, f. 2383.

Æsculus glabra, var. *arguta*, Robinson, *Gray Syn. Fl. N. Am.* i. pt. i. 447 (1897).

This variety, which ranges from Iowa to Kansas and eastern Texas, may be distinguished by its six to seven-foliolate leaves, with narrower lanceolate more acuminate and usually more sharply and generally doubly serrate leaflets than are usually found on *Æsculus glabra.* It was first distinguished at Larissa, Cherokee County, Texas, by S. B. Buckley.

Hypelate trifoliata, ii. 77. Add specific gravity of absolutely dry wood 0.9102; and weight per cubic foot 56.72 pounds.

Acer glabrum, ii. 95. Extend range northwestward along the Pacific coast to the passes at the head of the Lynn Canal, Alaska, or nearly to latitude 60° north. This plant is not rare on the coast of southeastern Alaska, although probably it is always shrubby. (See Meehan, *Proc. Phil. Acad.* 1884, 81, as *Acer rubrum;* see, also, F. Kurtz, *Bot. Jahrb.* xix. 369 [*Fl. Chilcatgebietes*].) Near Esquimo, Vancouver Island, on rocky sea cliffs this Maple grows to the height of forty feet and forms a trunk eighteen inches in diameter; and I have seen it of nearly the same size on the banks of streams among the Blue Mountains of Washington at an elevation of about four thousand feet above the sea. Extend range southward along the Sierra Nevada to the eastern fork of the Kaweah River, where in September, 1896, I found it as a bush five or six feet high at elevations of from eight thousand to nine thousand feet above the sea-level; and eastward to the elevated regions of Sioux and Scott's Bluff counties, northwestern Nebraska. (See Bessey, *Rep. Nebraska State Board Agric.* 1899, 89.)

Acer Negundo, ii. 111. "I am not certain if this tree is native in Pennsylvania. Around Easton it is spread everywhere over fields from the seeds of trees planted along the streets of the city." (T. C. Porter, *in litt.*)

Cotinus Americanus, iii. 3. Extend range to southwestern Missouri where it is common on the bluffs and rocky banks of streams tributary to the White River, and was first found during the summer of 1897 by Professor William Trelease on Swan Creek in the neighborhood of Taney City.

It is still common on the low limestone ridges about three miles east of Huntsville, Alabama.

Rhus Metopium, iii. 13. This name was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 964).

Rhus typhina, iii. 15. The Staghorn Sumach was described by Linnæus in the first edition of the *Species Plantarum* under the name of *Datisca hirta*, and it appears only in one of his later works as *Rhus typhina.* According to the rules of nomenclature followed in this work the first Linnæan specific name must be used and *Rhus hirta*, Sudworth, is therefore adopted for the Staghorn Sumach. The synonymy of this species as amended is as follows: —

Rhus hirta, Sudworth, *Bull. Torr. Bot. Club*, xix. 81 (1892). — Britton & Brown, *Ill. Fl.* ii. 386, f. 2348. — Britton, *Man.* 600.

Datisca hirta, Linnæus, *Spec.* 1037 (1753).

Rhus typhina, Linnæus, *Syst.* ed. 10, ii. 963 (1759); *Amœn.* iv. 311.

Toxicodendron typhinum, O. Kuntze, *Rev. Gen.* i. 154 (1891).

To this species were referred by Watson (*Index*), on what authority I do not know, and by some later authors, *Rhus Canadense*, Miller, *Dict.* ed. 8, No. 5 (1768), *Rhus hypselodendron*, Moench, *Meth.* 73 (1794), and *Rhus viridiflorum*, *Nouveau Duhamel*, ii. 163 (1808?). — Poiret, *Lamarck Dict.* vii. 504.

To his *Rhus typhina*, β *viridiflora*, Engler, *De Candolle Monog. Phaner.* iv. 378 (1883), refers the *Rhus viridiflora* of Poiret.

Rhus copallina, iii. 19. Extend range to Richardson County, southeastern Nebraska (Bessey, *Rep. Nebraska State Board Agric.* 1899, 90); and to eastern and southeastern Kansas (Hitchcock, *Flora of Kansas*, xii. *a*).

Cladrastis, iii. 55. It has usually been supposed that this genus was first published by Rafinesque in 1825 in his *Neogenyton*, or *Indication of Sixty-six New Species of Plants of North America;* but it was really published by him on February 21, 1824, on page 60 of the first volume of the *Cincinnati Literary Gazette* (*Neophyton* No. 1).

The buds of Cladrastis are naked and are not as described, "covered individually with thin lanceolate scales," and it is the young leaves and not bud-scales which are coated with lustrous tomentum.

Cladrastis lutea, iii. 57. Extend range to northern Alabama, where it was found in 1892 on the bluffs of the Tennessee River near Florence by Dr. C. Mohr as a shrub from six to eight feet high, and to Eagle Rock, Barry County, southwestern Missouri, where it was collected in June, 1897, by Mr. B. F. Bush.

Add to the synonymy of this species: —

? Sophora Kentuckea, Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 56 (1811).

Cladrastis fragrans, Rafinesque, *Cincinnati Literary Gazette*, i. 60 (Feb. 21, 1824).

Gleditsia triacanthos, iii. 75. Extend range to Houston County in the extreme southeastern part of Minnesota. (See Wheeler, *Minnesota Botanical Studies*, ser. 2, pt. iv. 392.)

Gleditsia aquatica, iii. 79. Extend range to western Illinois, where it is common on the bottoms of the Mississippi River opposite St. Louis, and where it was found near Cahokia in 1877 by Henry Eggert; and to La Pointe, St. Charles County, Missouri, where it was found in October, 1882, by Mr. Eggert.

Cercis Canadensis, iii. 95. Extend range to southern Ontario, where it was found on July 27, 1892, on Pelee Island in Lake Erie by Mr. John Macoun; and to eastern and southeastern Nebraska. (*Teste* Herb. University of Nebraska.)

Cercis Texensis, iii. 97. In the first line of the description of this tree "twenty or nearly forty feet in height" should read, — rarely forty feet in height, — and in the eighth line it should read that the petioles are abruptly enlarged and not contracted at both ends.

Pithecolobium, iii. 131. An older name for this genus is Zygia of Patrick Browne, *Nat. Hist. Jam.* 279 (1756); and as Ichthyomethia (iii. 51) of Browne has been adopted in this work instead of the more commonly used Piscidium of Linnæus, the same rule must be applied in the case of Zygia, and the three North American arborescent species become *Zygia Unguis-cati*, Sudworth, *Zygia brevifolia*, Sudworth, and *Zygia flexicaulis*, Sudworth. (See *Bull.* No. 14 *Div. Forestry U. S. Dept. Agric.* 248 [*Nomenclature of the Arborescent Flora of the United States*].)

Prunus nigra, iv. 15. Extend range to southeastern Minnesota, where it grows in Houston County on the bottoms of the north and south forks of Crooked Creek and on Winnebago Creek, and in East Burns Valley, Winona County. (See Wheeler, *Minnesota Botanical Studies*, ser. 2, pt. iv. 392.)

Prunus hortulana, iv. 23. Extend range to eastern and southeastern Kansas (Hitchcock, *The Industrialist*, 383 [*Flora of Kansas*]).

Prunus subcordata, iv. 31. Extend range to the dry plains north of upper Klamath Lake in southern Oregon east of the Cascade Mountains, where I found it in August, 1896, as a stunted shrub only three or four feet in height.

Prunus emarginata, iv. 37. Extend range southward along the western slope of the Sierra Nevada to the head of Kern River. (See Coville, *Contrib. U. S. Nat. Herb.* iv. 90 [*Bot. Death Valley Exped.*].) On the middle fork of the Kaweah River I found it in September, 1896, growing abundantly in dense thickets from four to six feet in height at an elevation of about eight thousand feet above the sea-level; extend range also to the San Rafael Mountains in Santa Barbara County, California, where it was found by Dr. F. Franceschi in May, 1894, and to the neighborhood of Flagstaff and the San Francisco Peaks in northern Arizona, where it was collected in June and July, 1891, by Mr. D. T. McDougal.

Prunus Caroliniana, iv. 49. In the second paragraph of the description of this tree Mississippi should be substituted for Missouri.

Cercocarpus ledifolius, iv. 63. Extend range to Snow Lake Valley, Klamath County, Oregon, where it was collected on June 9, 1896, by Mr. Elmer I. Applegate; and to the Blue Mountains of Washington, where, on July 31, 1896, I found a single tree on the Touchet River at an elevation of about five thousand feet above the sea-level.

Pyrus sambucifolia, iv. 81. In the fourth volume of this work published in 1892 two species of Pyrus of the section Sorbus were admitted, *Pyrus Americana*, De Candolle, a widely distributed eastern species, and a tree of the northeast, referred to *Pyrus sambucifolia*, Chamisso & Schlechtendal, which is a species of northeastern Asia and which was believed to be widely scattered also through western North America and to cross the continent to the shores of Labrador. An examination of the type specimen of *Pyrus sambucifolia* preserved in the herbarium of the Imperial Botanic Garden at St. Petersburg shows that that species differs from the plant which was figured in this *Silva* as *Pyrus sambucifolia* and from the different shrubby species of Sorbus of western North America. From these the eastern tree may be distinguished by its abruptly acuminate leaves and larger fruits usually in broader and more numerously fruited clusters.

The tree of the northeast, the *Pyrus sambucifolia* of the fourth volume of *The Silva*, in its typical form is easily distinguished from *Pyrus Americana* by its broader abruptly acuminate blue-green leaflets, by its larger flowers which usually open eight or ten days later, and by its much larger fruits; but there are forms which appear intermediate between the two or are possibly hybrids between them, and the best observers are still in doubt whether this tree should be considered a species or a variety of *Pyrus Americana*. For the present, therefore, it may be well to consider it a variety, for which I suggest the name of *decora* in allusion to its handsome fruit.

The synonymy of this tree would then be: —

Pyrus Americana, var. *decora*.

Sorbus aucuparia, β Michaux, *Fl. Bor.-Am.* i. 290 (1803).

Pyrus aucuparia, Meyer, *Pl. Lab.* 81 (in part) (not Linnæus) (1830).

Pyrus sambucifolia, Gray, *Man.* ed. 5, 161 (in part) (not Chamisso & Schlechtendal) (1868). — Macoun, *Cat. Can. Pl.* 146 (in part). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 74 (in part); *Silva N. Am.* iv. 81 (in part), t. 173, 174. — Macmillan, *Metaspermæ of the Minnesota Valley*, 283 (in part). — Rand & Redfield, *Fl. Mt. Desert Island*, 98.

Sorbus sambucifolia, Britton & Brown, *Ill. Fl.* ii. 233 (in part), f. 1976 (not Roemer) (1897). — Britton, *Man.* 515.

Pyrus Americana, var. *decora* ranges from the coast of Labrador to the northern shores of Lake Superior and to Minnesota, and southward to the elevated regions of northern New Hampshire, Vermont, and New York.

Lyonothamnus floribundus, iv. 135. Extend range to San Clemente Island, California, where it was discovered in 1896 by Mrs. Blanche Trask. (See *Erythea*, v. 30.)

Hamamelis Virginiana, v. 3. This name was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 90).

Rhizophora Mangle, v. 15. The Mangrove grows in the United States probably only in Florida, and the previous statements that it grows on the delta of the Mississippi River and on the coast of Texas are, I now believe, erroneous.

Eugenia procera, v. 47. Add specific gravity of absolutely dry wood 0.9453; and weight per cubic foot 58.91 pounds.

Cornus florida, v. 66. Extend range to southeastern Kansas (Hitchcock, *Flora of Kansas*, xiii.).

Nyssa Ogeche, v. 79. Extend range to the basin of the lower Appalachicola River, where it is very abundant on the borders of Cypress swamps down to within a few miles of the Gulf coast, and where it grows to the height of sixty or seventy feet, and usually forms several stems which are sometimes a foot and a half in diameter.

The excellent quality of the honey made from the abundant nectar of the flowers of this tree is recognized, and bee farms have been established on the lower Appalachicola River in the neighborhood of the swamps where it grows.

Nyssa aquatica, v. 83. Add to the bibliography of *Nyssa aquatica* of Linnæus, Linnæus, *Syst.* ed. 10, ii. 1313 (1759).

Sambucus glauca, v. 91. Extend range eastward through northern Idaho to northern Montana, where in July, 1896, I found it growing as a shrub from four to six feet in height near Columbia Falls, north of Flathead Lake.

Viburnum Lentago, v. 96. Extend range to South Dakota, where it is common in the valley of the Minnesota River and in the valleys of the Black Hills, and occurs near Sioux Falls in the Sioux River valley (see Saunders, *Bull.* No. 64 *South Dakota Agric. College*, 196 [*Ferns and Flowering Plants of South Dakota*]); to the Big Horn Mountains of Wyoming, where it was found in August, 1900, by Mr. J. G. Jack, at an elevation of forty-three hundred feet above the level of the sea; and to eastern Kansas (Hitchcock, *Flora of Kansas*, xvii.).

Vaccinium arboreum, v. 119. Extend range to southeastern Kansas, where it has been found by E. N. Plank near Galena, Cherokee County.

Arbutus Andrachne, v. 122. This name was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 1024).

Andromeda ferruginea, v. 131. Extend range to Tampa, Florida, where it was collected March 29, 1898, by C. S. Sargent; to Appalachicola, where it was collected in low sandy Pine barrens March 10, 1888, by Dr. A. W. Chapman; and to Mary Esther, Santa Rosa County, Florida, where it was found by Dr. C. Mohr in October, 1880.

Oxydendrum arboreum, v. 135. Extend range to Exmore, Hampton, and Old Point Comfort on the east coast of Virginia, where it is abundant. (*Teste* W. M. Canby.)

Chrysophyllum oliviforme, v. 161. What is probably the Florida tree, judging from Plumier's figure (*Pl. Am.* ed. Burmann, t. 69), was first described by Linnæus as *Chrysophyllum oliviforme* in the tenth edition of the *Systema* (p. 937), published in 1759, and not by Lamarck.

Add to the synonyms: —

Chrysophyllum Cainito β, Linnæus, *Spec.* 192 (1753).

Bumelia lanuginosa, v. 171. Extend range to Eustis, Lake County, Florida, where it was found in July, 1895, by Mr. G. B. Nash; to the neighborhood of Appalachicola, Florida, where it was collected in June, 1897, by Dr. A. W. Chapman; and to southeastern Kansas (Hitchcock, *Flora of Kansas*, xiii.).

Fraxinus quadrangulata, vi. 35. Extend range to southeastern Kansas (Hitchcock, *Flora of Kansas*, xiii.).

Fraxinus anomala, vi. 39. Extend range to the cañon of the Gunnison River at Grand Junction, western Colorado, where it has been found by Miss Alice Eastwood (see *Zoë*, ii. 232), to the banks of Grand River in Utah, where it has also been collected by Miss Alice Eastwood (see *Proc. Cal. Acad.* ser. 2, vi. 305); to the southern rim of the Grand Cañon of the Colorado River, where it was found at Talfrey, Arizona, in September, 1894, by Toumey and Sargent; and to the Mogollon Mountains, New Mexico, where it was collected in April, 1881, by Professor E. L. Greene.

Fraxinus Pennsylvanica, vi. 49. Extend range to central Kansas (Hitchcock, *Flora of Kansas*, xiii.).

Fraxinus Pennsylvanica, var. **lanceolata**, vi. 50. Extend range southward in Florida to the deep river-swamps of the lower Appalachicola River basin, where it is very abundant and grows probably to its largest size, often forming trunks three feet in diameter; and to Assiniboin, where it was collected by Mr. John Macoun on the shores of Old Wives' Lakes in 1895 and south of Moose Jaw in 1896. (See *Canadian Record of Science*, vii. 281.)

Large quantities of lumber manufactured from this tree in the sawmills of Appalachicola are sent to the north, where it is used in the interior finish of houses and in cabinet-making.

Catalpa Catalpa, vi. 86. *Catalpa communis* was first published in 1802 in the first edition of Du Mont de Courset's *Bot. Cult.* (ii. 189).

Crescentia cucurbitina, vi. 99. Remove from the synonyms *Crescentia ovata*, Burmann, an East Indian species, and add *Crescentia ovata*, Sudworth (*Bull.* No. 14 *Div. Forestry U. S. Dept. Agric.* 336 [*Nomenclature of the Arborescent Species of the United States*] [not Urban] [1887]).

Sassafras Sassafras, vii. 17. Extend range to the neighborhood of Wells, York County, Maine, where it was found September 16, 1895, by Mr. Walter Deane; and to the neighborhood of Sarnia, Lambton County, Ontario. (See *Canadian Record of Science*, vii. 285.)

Ulmus campestris, vii. 40. Add to the synonyms: —

Ulmus nitens, Moench, *Meth.* 333 (1794).

Ulmus surculosa, Stokes, *Bot. Mat. Med.* ii. 35 (1812).

Ulmus scabra, vii. 40. An older name for this tree is *Ulmus glabra*, Hudson, *Fl. Angl.* 95 (1762). Add to the synonyms: —

Ulmus latifolia, Moench, *Meth.* 333 (1794).

Ulmus lævis, vii. 40. Add to the synonyms: —

Ulmus racemosa, Borkhausen, *Handb. Forstbot.* i. 851 (1800).

Ulmus racemosa, vii. 48. This name was used by Borkhausen in 1800 for a European species of Elm (*Handb. Forstbot.* i. 851), and therefore was not applicable to the American tree, for which the name *Ulmus Thomasi* is proposed.

Extend range to Woodruff's Gap, Sussex County, New Jersey, where it was found by Porter & Britton September 17, 1867; and to Marathon, Langlade, and Shawano counties, central Wisconsin, where it is still sufficiently abundant to be of commercial importance. (*Teste* G. B. Sudworth.)

In western Missouri *Ulmus Thomasi* is not rare in the valley of the Missouri River near Courtney, where it was found by Mr. B. F. Bush in April, 1894, and near Kansas City, where it was found the following year by Mr. William Mackenzie. It is not known to me to grow naturally in Tennessee, where it is replaced by *Ulmus serotina*. (See xiv. 41.)

Ulmus fulva, vii. 53. Extend range to western and northern Kansas (Hitchcock, *The Industrialist*, xxiv. 323 [*Flora of Kansas*]).

Celtis occidentalis, vii. 67. Extend range to the extreme western part of Kansas (Hitchcock, *The Industrialist*, xxiv. 323 [*Flora of Kansas*]).

Celtis Mississippiensis, vii. 71. Extend range into southwestern Kansas (Hitchcock, *The Industrialist* xxiv. 323 [*Flora of Kansas*]).

Morus rubra, vii. 79. Extend range to Pownal in southwestern Vermont, where there are a few small plants which were first noticed about 1830 by William Oakes (see Thompson, *History of Vermont, Natural, Civil, and Statistical*, pt. i. 196), and rediscovered in August, 1898, by Mr. W. W. Eggleston (see Clark, *Bull.* No. 73 *Vermont Agric. Exper. Stat.* 64. — Brainerd, Jones & Eggleston, *Fl. Vermont*, 35); and to the valley of the Sioux River in the southeastern county of South Dakota. (See Saunders, *Bull.* No. 64 *S. Dakota Agric. College*, 134 [*Ferns and Flowering Plants of South Dakota*].)

Juglans cinerea, vii. 118. This name was first published by Linnæus in 1759 in the tenth edition of the *Systema* (ii. 1272).

Juglans nigra, vii. 121. Extend range westward in Kansas to the latitude of the ninety-ninth meridian (Hitchcock, *The Industrialist*, xxiv. 323 [*Flora of Kansas*]).

Hicoria minima, vii. 141. The statement on page 143 that "north of the coast Pine belt of Alabama and Mississippi it is the most multiplied species on the poor dry gravelly soil of the uplands" should refer to *Hicoria villosa*. (See xiv. 47.) In this region and in central Georgia *Hicoria minima* appears to be confined to river-banks, and, although it grows in this region to its largest size, it is not common. The most southern points from which I have seen specimens are the banks of the Appalachicola River below Chattahoochee, Florida, where it was found by Dr. Charles Mohr in June, 1880, and Cullman, Alabama, where it was collected by Dr. Mohr in March, 1884.

Hicoria laciniosa, vii. 157. Extend range to southeastern Michigan, where it is abundant on Belle Isle in the Detroit River, and where it was found by C. S. Sargent in May, 1899, and to Ontario adjacent to the Detroit River; to Richardson County, southeastern Nebraska, where it was first found in 1890 (*teste* Herb. University of Nebraska); to the bottoms of Chattanooga Creek, Chattanooga, Tennessee, where it grows to a large size, and was found on October 6, 1898, by John Muir, W. M. Canby, and C. S. Sargent; and to the neighborhood of Farmington, Davis County, North Carolina, where it was found on the flats of Dutchman's Creek in 1895 by Mr. F. E. Boynton. Large trees of this species, some of them probably planted more than a hundred years ago are growing at Clairmont, Brandon, Shirley, and other estates on the James River, Virginia, where this tree is called Gloucester Broad-nut.

Quercus alba, viii. 16. Extend range westward in Canada to the shores of Rainy Lake, Ontario, where it was found in 1896 by Mr. W. McInness. (See *Canadian Record of Science*, vii. 285.)

Quercus macrocarpa, viii. 43. Extend range to Winslow and Waterville, Kennebec County, Maine, where it is abundant in dry woods and where it was found in September, 1898, by Mr. M. L. Fernald; to the southern borders of Berkshire County, Massachusetts, where it is rare and local (see Averill, *Rhodora*, ii. 36); and to the neighborhood of Wilmington, Delaware, where a single large tree growing in the woods was first noticed in 1890 by Mr. W. M. Canby.

Quercus Douglasii, viii. 79. *Quercus Œrstediana* (R. Brown Campst. *Ann. Mag. Nat. Hist.* ser. 4, vii. 250 [1871]), doubtfully referred to *Quercus Garryana* (viii. 29), is shown to be *Quercus Douglasii* by Mr. Brown's specimens recently presented by his son to the Royal Gardens at Kew.

Quercus chrysolepis, viii. 105. *Quercus oblongifolia* (R. Brown Campst. *Ann. Mag. Nat. Hist.* ser. 4, vii. 252 [not Torrey] [1871]), doubtfully referred to *Q. Douglasii* (viii. 79), is shown to be *Quercus chrysolepis* sub-species *vacciniifolia*, by Mr. Brown's specimens recently presented by his son to the Royal Gardens at Kew.

Quercus tomentella, viii. 109. Extend range to San Clemente Island, California, where it was discovered in 1896 by Mrs. Blanche Trask. (See *Erythea*, v. 30.)

Quercus myrtifolia, viii. 123. On the sandy shores of St. George's Sound, near Carribel, to the eastward of the mouth of the Appalachicola River in Florida, *Quercus myrtifolia* sometimes assumes a treelike habit, rising to a height of twenty-five feet and forming a straight trunk from four to six inches in diameter.

Quercus Texana, viii. 129. Extend range through northern Alabama, southeastern Tennessee, and northern Georgia to the banks of the Congaree River near Columbia, South Carolina, where it grows to a very large size and where it was found in May, 1897, by W. M. Canby and C. S. Sargent, to the Piedmont plateau of North Carolina (Ashe, *Bot. Gazette*, xxiv. 376), and to the Atlantic coast plain in Onslow County, North Carolina (Ashe, *Bot. Gazette*, xxviii. 271). It is common but of small size on dry limestone hills near Huntsville, Alabama, on Orchard Knob and other limestone hills near Chattanooga, Tennessee, on the dry banks of the Coosa River at Rome, Georgia, and near Atlanta, Georgia. Extend range also to Starkville, Oktibbeha County, Mississippi, where it was found in October, 1894, by Professor M. S. Tracy; to Post Oak, Lowndes County, Mississippi, where it was collected by Dr. Charles Mohr in October, 1894; and to southeastern Kansas (Hitchcock, *The Industrialist*, xxiv. 323 [*Flora of Kansas*]).

Quercus velutina, viii. 137. Extend range to southeastern Nebraska, where it was collected near Nebraska City in 1894 by Mr. J. H. Masters. (*Teste* Herb. University of Nebraska.)

Quercus palustris, viii. 151. Extend range to southwestern Tennessee, where it is common on bottomlands in the neighborhood of Memphis.

Quercus imbricaria, viii. 175. It was probably an error to consider this tree an inhabitant of Wisconsin. The neighborhood of Muscatine in southeastern Iowa is now believed to be the most northern station, where it grows in the Mississippi valley. (*Teste* L. H. Pammel.)

Fagus Americana, ix. 27. The range of this tree in Wisconsin is confined to the eastern counties, where it is common, especially near the shores of Lake Michigan.

Ostrya Virginiana, ix. 34. Extend range southward in Florida to Lake City, Columbia County, where it was collected in July, 1895, by Mr. G. B. Nash. During the summer of 1899 Mr. C. G. Pringle found this tree in the neighborhood of Jalapa in southern Mexico.

Carpinus Caroliniana, ix. 42. During the summer of 1899 Mr. C. G. Pringle found in Mexico *Carpinus Caroliniana* on the mountains near Jalapa and Orizaba at an elevation of about four thousand feet above the level of the sea and at an elevation of six thousand feet above the sea near Cuernavaca, where in the deep rich cañons of the mountains which form the southern rim of the valley of Mexico this tree, surpassing in size all the known Hornbeams of the world, reaches a height of one hundred feet and forms a trunk from three to four feet in diameter.

Betula lenta, ix. 50. Extend range to central Iowa, where it was found in 1900 at Steamboat Rock near the banks of the Iowa River by L. H. Pammel.

Betula papyrifera, ix. 57. Extend range to central Iowa, where it was found in June, 1900, at Steamboat Rock near the banks of the Iowa River by L. H. Pammel.

Alnus, ix. 67. Betula and Alnus were first united by Linnæus in the tenth edition of the *Systema* (ii. 1265), published in 1759, and subsequently in the sixth edition of the *Genera*, published in 1764.

Alnus glutinosa, ix. 69. *Betula glutinosa* was first published in 1759 by Linnæus in the tenth edition of the *Systema* (ii. 1265), and subsequently by Lamarck in 1783.

Alnus tenuifolia, ix. 75. Extend range northward in British Columbia to latitude 61, where it was found on the shores of Francis Lake on July 16, 1887, by Dr. G. M. Dawson; and eastward along the Saskatchewan to the neighborhood of Prince Albert, where it was found in July, 1896, by Mr. John Macoun. (See, also, xiv. 62.)

Myrica cerifera, ix. 87. Extend range northward to Millsborough, Sussex County, Delaware, where it is common in sandy barrens as a low broad shrub, and where it was found on October 12, 1898, by John Muir, W. M. Canby, and C. S. Sargent; and to Cape May, New Jersey, where it was found March 30, 1899, by Mr. W. M. Canby, and where in sandy soil close to the sea it is a tree from twenty-five to thirty feet in height.

Salix Wardi, ix. 107. This is the common Willow of the Ozark mountain region of southwestern Missouri and northwestern and western Arkansas, where it is very abundant on rocky banks of all streams, often growing to the height of thirty feet, and forming a trunk from twelve to eighteen inches in diameter.

Salix Bebbiana, ix. 131. Extend range to the shores of Cook Inlet, Alaska. (See Coville, *Proc. Washington Acad. Sci.* ii. 283; iii. 306.)

Salix Missouriensis, ix. 137. Extend range eastward to Iowa, where this tree grows in the Mississippi River valley near Sioux City in the extreme northwestern part of Lyon County, and in the Mississippi River valley in the neighborhood of Davenport and Muscatine (see Ball, *Proc. Iowa Acad. Sci.* vii. 152); and through northeastern Kansas to Riley County, Kansas (Hitchcock, *The Industrialist*, xxiv. 323 [*Flora of Kansas*]).

Salix Sitchensis, ix. 149. In Alaska *Salix Sitchensis* ranges northward and westward to the shores of Cook Inlet and Kadiak Island, ascending to elevations of at least fourteen hundred feet above the sea-level. The wood is sometimes used by the coast Indians of southern Alaska for frying salmon, as the smoke does not give a bad taste to the fish. The pounded bark is employed to heal the flesh of cuts and wounds. (See Coville, *Proc. Washington Acad. Sci.* ii. 278; iii. 307.)

Populus tremuloides, ix. 158. Change range from southern Nebraska to Pine Ridge, northwestern Nebraska. (*Teste* Professor C. E. Bessey.) "In the valley of the Yukon and its tributaries *Populus tremuloides* is abundant on old river levels and dry hillsides, but rarely occurs on the rich bottom-lands. It seldom exceeds twelve inches in diameter or fifty or sixty feet in height. *Populus balsamifera* is much less common, although it is fairly abundant on all bottom-lands and creeks and river banks. It is a much larger tree than *Populus tremuloides*, sometimes reaching sixteen or eighteen inches in diameter and about seventy feet or more in height when growing on rich alluvial soil." (M. W. Gorman, *in litt.*)

Populus grandidentata, ix. 161. Extend range to northeastern Iowa and southward along the Mississippi River to the neighborhood of Muscatine, to Steamboat Rock on the Iowa River, in Hardin County, and to the Ledges, Boone County, in the central part of Iowa. (*Teste* L. H. Pammel.)

Populus heterophylla, ix. 163. Extend range in Connecticut northward to Southington, where it was found during the summer of 1901 by Mr. C. H. Bissell.

Populus angustifolia, ix. 171. Extend range to the Chiricahua Mountains in the extreme southern part of Arizona, where it was found in 1897 by Professor J. W. Toumey.

Oreodoxa regia, x. 31. In 1774 William Bartram visited the upper St. John River, Florida, and noticed Palm-trees which seemed to him "to be of a different species from the Cabbage-tree; their strait trunks are sixty, eighty, or ninety feet high, with a beautiful taper of a bright ash colour, until within six or seven feet of the top, where it is a fine green colour, crowned with an orb of rich green plumed leaves: I have measured the stem of these plumes fifteen feet in length, besides the plume, which is nearly of the same length." (*Travels*, 115.)

Of the Palms of Florida this description can apply only to *Oreodoxa regia*, although I cannot learn that it now grows anywhere near the St. John River or that it has been seen there by any later traveler. It is possible that it is these trees to which Nuttall alludes in the preface of his *Sylva of North America* (p. viii.).

Juniperus Utahensis, x. 81. Add to the synonymy: —

Juniperus Knighti, Nelson, *Bot. Gazette*, xxv. 198, f. 1, 2 (1898); *Bull.* No. 40 *Wyoming Exp. Stat.* 88, f. 18, 19 (*Trees of Wyoming*); and extend range into southern Wyoming, where it is common in the Red Desert region from the Seminole Mountains to Green River.

Juniperus sabinoides, x. 91. This name as applied to this tree was first published by Nees von Esenbeck in *Linnæa*, xix. 706, in 1847. The great Cedar Brake on the San Bernard River in Brazoria County, Texas, is composed of this species, which sometimes attains a height of a hundred feet here. (*Teste* B. F. Bush, who visited it in 1900.)

Cupressus Macnabiana, x. 109. Extend range from central Napa County, California, where it has been found by Mr. Carl Purdy on Mt. Ætna, northward through Lake County, where it is now known to abound on the tributaries of the Lake, and on the slopes of Mt. Raynor, and to Red Mountain on the eastern side of Ukiah valley in Mendocino County, where it has been found by Mr. Purdy. In July, 1901, Miss Alice Eastwood found *Cupressus Macnabiana* on the road between Shasta and Whiskeytown, Trinity County, California, probably near the place where it was originally discovered by Jeffrey. (See *Bull. Sierra Club*, iv. 41.)

Cupressus Nootkatensis, x. 115. Extend range eastward to Stevens' Pass in northeastern Washington, where it was found by J. H. Sandberg and J. P. Leiberg at elevations of from four thousand to six thousand feet above the sea in August, 1893; and northwestward to Khantaak Island in Yakutat Bay, where a single tree was seen by Frederick Funston in 1892. (See *Contrib. U. S. Nat. Herb.* iii. 328.)

Thuya occidentalis, x. 126. Extend range to northeastern Tennessee, where it was found on the Holston River at Fishdam, Sullivan County, on June 10, 1897, by Mr. G. B. Sudworth.

Thuya gigantea, x. 129. Yas Bay is the extreme northwestern station from which I have seen specimens of this tree. Southeast of Yas Bay it is not rare on the Alaska coast, growing from the sea-level up to elevations of fifteen hundred feet and surpassed only by the Tideland Spruce in size.

Masters has shown that the oldest name for this tree is *Thuya plicata*, which should be adopted for it. (See *Gard. Chron.* ser. 3, xxi. 101, 213, 258.) *Thuya plicata* was first used by James Donn in the fourth edition of the *Hortus Cantabrigiensis*, published in 1807, but as the name was unaccompanied by any description it becomes

a *nomen nudum*, and the author of the species is David Don, who described this tree in the second volume of Lambert's *Genus Pinus*, published in 1824, his description being based on a specimen collected by Née (see viii. 25) and preserved in the British Museum. Née's specimen is ascribed to New Spain, but, as Dr. Masters points out, this is clearly an error in the inscription on the label as there is no Thuya in Mexico, and Née in his voyage with Malaspina also visited different parts of the northwest coast. Malaspina's voyage extended from 1789 to 1794, when he arrived on his return in Cadiz, so that it is Née who discovered this tree and not Menzies, who was not at Nootka Sound until 1796. The *Thuya plicata* of northwestern America discovered by Née and subsequently by Menzies must not be confounded with the *Thuya plicata* of gardens, which is a form of *Thuya occidentalis* of eastern America.

Libocedrus decurrens, x. 135. Extend range eastward in southern Oregon to the eastern slope of the Cascade Mountains, where it is common above the shores of Upper Klamath Lake at elevations of about twenty-two hundred feet and where it does not grow to a large size. On the Warner Range still farther east it grows in the Yellow Pine belt, but it is not common and rarely forms a trunk exceeding two feet in diameter (C. Hart Merriam, *in litt.*). Extend range in California to the Santa Lucia Mountains, to Mt. San Carlos near New Idria in San Benito County, and to the San Rafael Mountains in Santa Barbara County, where it was found in May, 1894, at elevations of five thousand feet above the sea by Dr. F. Franceschi.

Sequoia, x. 139. Emend description of the fruit to read "maturing during its first or second season." The fruit of *Sequoia sempervirens* appears always to ripen during one season, but in the case of *Sequoia Wellingtonia*, which flowers early in the year, the young cone grows during the first season to about half its full size and, beginning to grow again late in the winter or in very early spring, attains its full size in May, when the seeds are ready to germinate, although the cones do not open naturally until August or September after the hot dry season. (See Sargent, *Garden and Forest*, x. 514, f. 66.)

Pinus quadrifolia, xi. 43. Extend range in California to the desert slopes of the Santa Rosa Mountains, Riverside County, where it is abundant at an elevation of five thousand feet above the level of the sea and where it has been found by Mr. H. M. Hall. (See *Erythea*, vii. 89.)

Pinus clausa, xi. 127. Extend range southward along the east coast of Florida to five or six miles south of New River or Fort Lauderdale.

Pinus glabra, xi. 131. Extend range to central Mississippi, where it is common on the low wooded borders of streams and swamps, and to the swamps adjacent to Bayou Phalia, eastern Louisiana.

Pinus divaricata, xi. 147. Extend range to the eastern slope of Green Mountain, Mount Desert Island, Maine, where it was found by Mr. E. L. Rand in July, 1898. (See *Rhodora*, i. 135.)

Larix Americana, xii. 7. Extend range southward to Preston County, West Virginia, where in May, 1897, it was found by Professor A. D. Hopkins near Cranesville at an elevation of about twenty-three hundred and sixty feet above the level of the sea growing in a sphagnum-covered swamp. (See 10*th Ann. Rep. West Virginia Agric. Exp. Stat.* 50.)

Larix Lyallii, xii. 15. Extend range southward in the United States along the continental divide, where it has been found to extend in many scattered colonies, to the neighborhood of Camp Creek Pass at the head of the middle fork of Sun River. Here it forms a pure forest of considerable extent at an elevation of from seven thousand to eight thousand feet above the sea-level, and was found by Mr. H. B. Ayres in August, 1899; and to Pend d'Oreille Pass between the waters of the Clearwater River and those of the west fork of the south fork of the Flathead River, where it was found at an elevation of seven thousand feet by Mr. Ayres in September, 1899.

Picea Mariana, xii. 28. Extend range as far north as least at the valley of the Klondike in the Yukon Territory, where it is very common from the Yukon valley as far west as the west bank of White River at a point two hundred and twelve miles above the mouth of that stream, and where it was first noticed in 1899 by Mr. Martin W. Gorman. "West of the Yukon it occurs in all wet marshy localities and is to be found growing over buried glaciers wherever they occur in that region, but I did not observe it anywhere on the rich bottom-lands along the immediate banks of the Yukon. It is a much smaller tree than the White Spruce, seldom reaching eighty feet in height or producing a trunk exceeding twelve inches in diameter. Owing to the scarcity of timber it is sometimes cut and makes better lumber and fuel than the White Spruce, as it is darker, harder, and closer-grained." (Gorman, *in litt.*)

Picea Canadensis, xii. 37. Extend range southward in Wisconsin through the northern part of the state. (*Teste* L. S. Cheney.)

Tsuga Canadensis, xii. 63. In Wisconsin the southern station of the Hemlock is in Iowa County in the

southwestern part of the state, where there is a grove of this tree on a bluff on the east bank of the Pecatonica River about six miles north of Blanchardville, Lafayette County, and two miles east of Hollondale, Iowa County. (L. S. Cheney *in litt.*)

Tsuga Mertensiana, xii. 77. Extend range northwestward along the Alaska coast to the shores of Prince William Sound, where, during the summer of 1899, at the head of an icy ford, John Muir found trees of this species from eighty to one hundred feet in height with trunks from two to three feet in diameter forming a pure forest; and eastward in Montana to the pass between the head of Sun River and the head of the Clearwater, and about fifteen miles east of McDonald's Peak, where at an elevation of five thousand feet above the sea-level a small grove of stunted trees was seen during the summer of 1899 by Mr. H. B. Ayres.

Pseudotsuga Japonica, xii. 84. This name was first used by Beissner (*Mitt. Deutsche Dendr. Gesell.* Nr. 5, 62 [1896]).

Abies balsamea, xii. 107. In Wisconsin this tree occurs only in the northern and central parts of the state, where it is common, and is entirely unknown in the southern counties, the station in northeastern Iowa being an isolated one.

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